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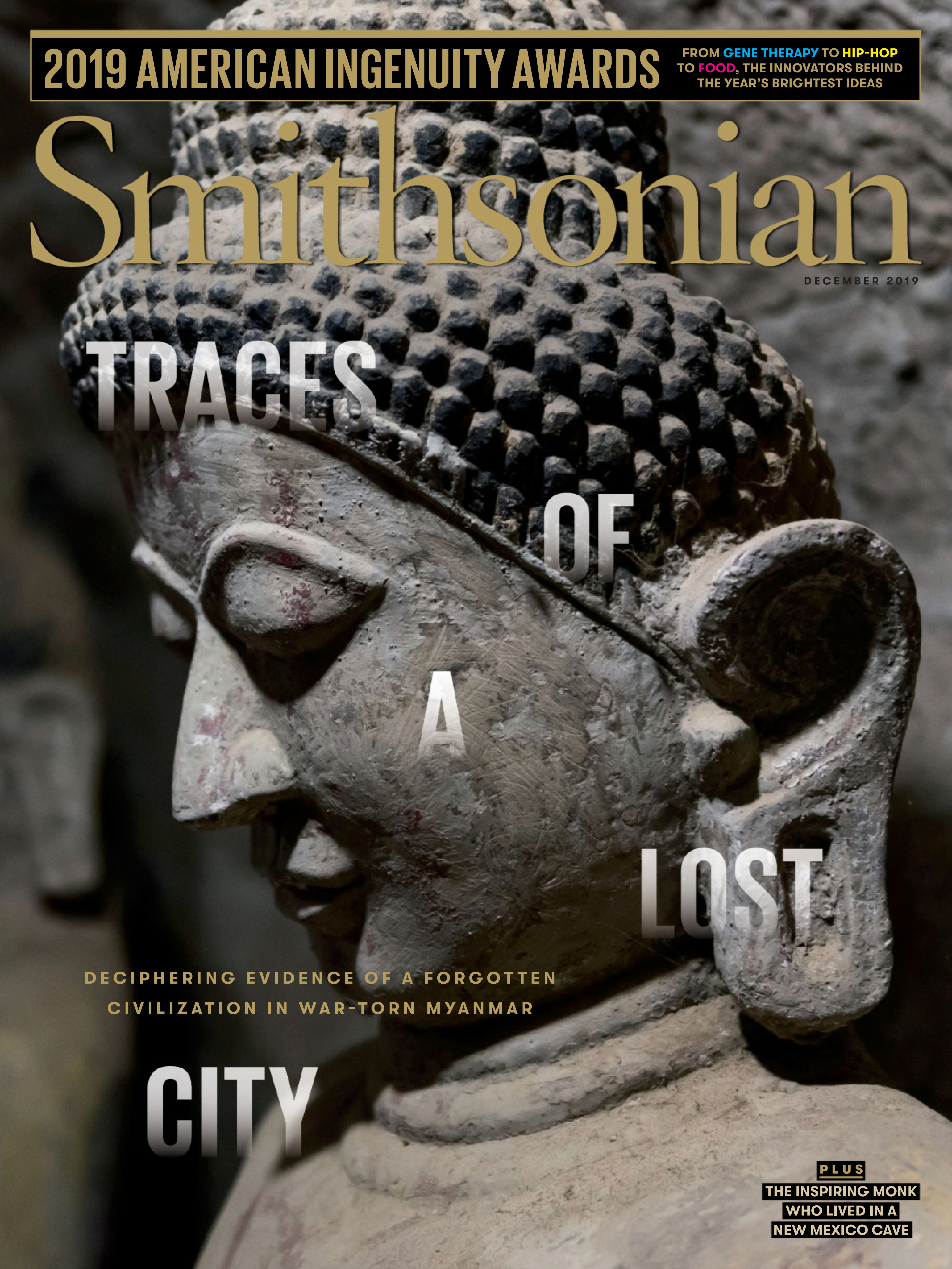

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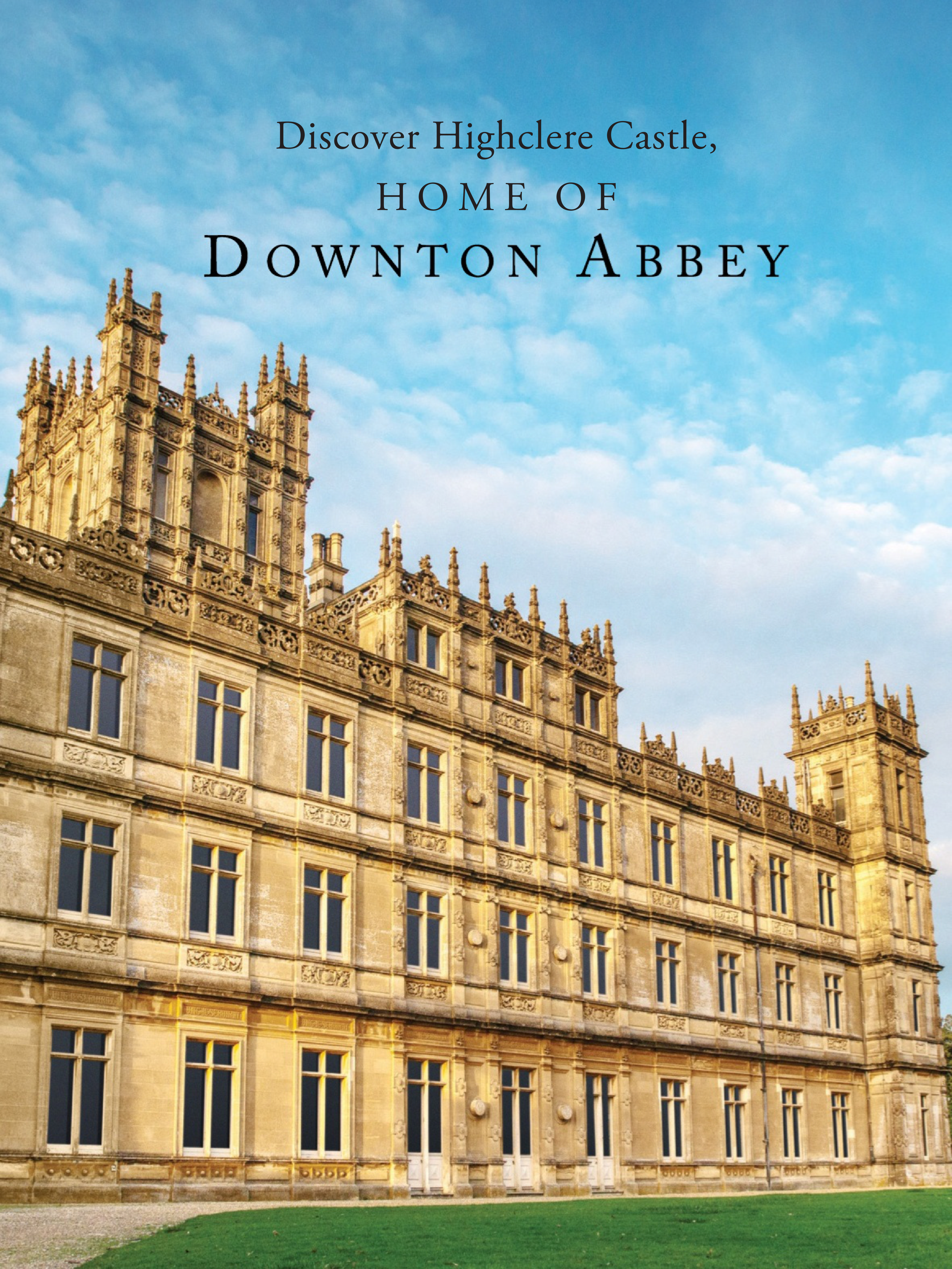

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Cover: A 16th-century stone statue of Buddha inside Shitthaung temple in Mrauk U in western Myanmar.

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THE CALL OF THE WILD
THE INCREDIBLE DANGEROUS JOURNEY THAT TURNED YOUNG JACK LONDON INTO A BLOCKBUSTER NOVELIST

FROM THE EDITORS

"I DO BELIEVE the spirit of Jack London was with Richard Grant," Tawnya Ison in Medford, Oregon, wrote about our November cover story retracing the *Call of the Wild* author's Yukon journey. "Fantastic writing and a true adventure to read!" Don M. Pike of Crawford, Texas, was struck by "Behind the Lines," about a secret mission to capture Nazi mapping data: "We're all certainly indebted to these courageous people and the risks and sacrifices they endured." The story that provoked the biggest response (most of it, admittedly, negative) was "Che's Kid Hits the Road," about a motorcycle tour of Cuba given by a son of Che Guevara, one of the leaders of the country's revolution. Though the travel article mentioned Che's brutality, many readers said the piece glorified the rebel leader and didn't go far enough in criticizing the Communist government.

The Map Hunters

My sister Holly and I grew up with these stories and only later when our father, Ray Johnson, committed them to writing did we understand the impact of these events on his life. Now, to see some of the same observations put into a deeply researched narrative is very powerful and moving. He never dreamed that his manuscript would contribute to an important and intriguing national story.

— **Paula Eastwood** | Albuquerque, New Mexico

My father was a Scout/Ranger with the Fourth Infantry Division spotting artillery as a forward observer from Utah Beach to the occupation of Germany. I imagine the data gleaned from the recovered documents was applied by the 29th Field Artillery as it battled across Europe: information that aided his survival—and my eventual existence.

— **George R. Clark** | Wisconsin Rapids, Wisconsin

Another Side to Che

What a whitewashing of the life and effect of Che Guevara ("Che's Kid Hits the Road"). Although he helped Castro dispose of a dictator, what was the result? He helped create and support an even more repressive regime, from which thousands have been desperate to escape over the past 60 years. No one immigrates to Cuba, it has never been able to support itself under this regime, and the non-elites are unvaryingly suffering from shortages of food and medicine. A more balanced article would better serve your readership.

— **Darryl Engle** | Chandler, Arizona

Maybe you could interview some of the Cuban-Americans who survived Castro and Che's regime. They would have a different perspective on what kind of man Che was.

— **Steve Moore** | Oceanside, California

Letters From the Front Lines

What a treasure trove! As we now head toward a totally digital world, these letters ("The News From Over There") are an invaluable look at a world before iPhones and computers. They give us a window into not only the day-to-day lives of these fighting men, but also the day-to-day lives of their families—something no newsreel will ever show.

— **D.L. Moore** | Hesperia, California

I am moved by the dedication of Mr. Carroll and his staff in this endeavor. It is a vital opportunity and responsibility to collect, save and cherish the thoughts and feelings of our military.

— **Christy Collins** | Goshen, New York

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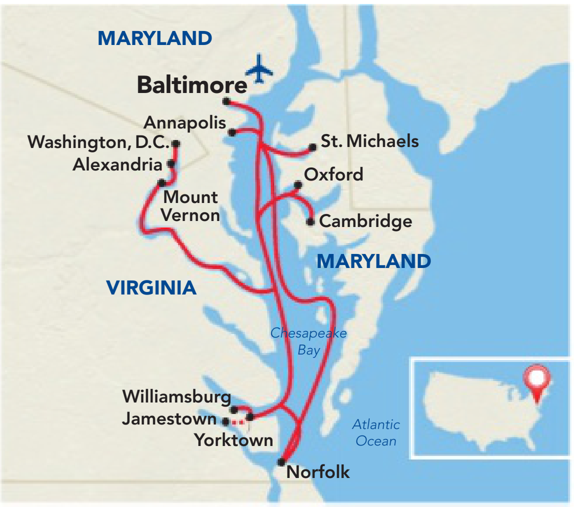
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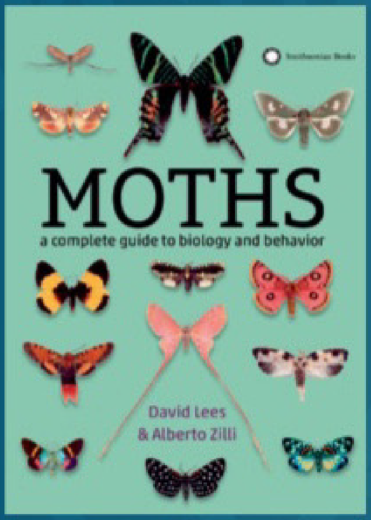
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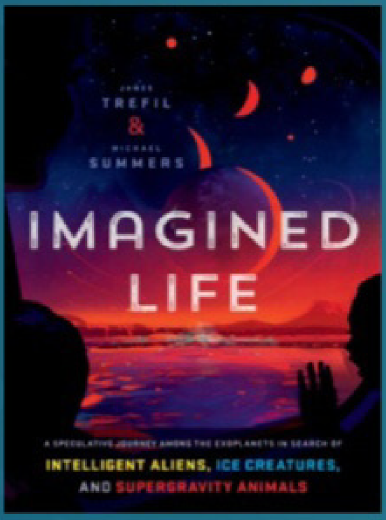
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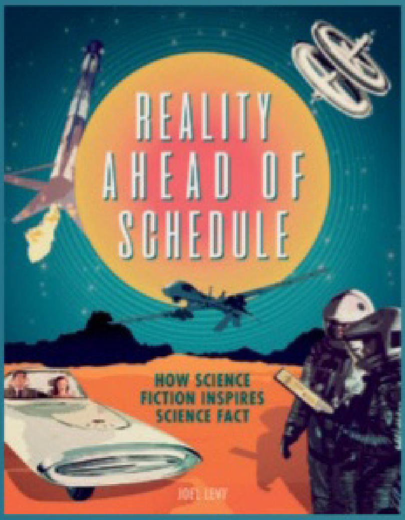
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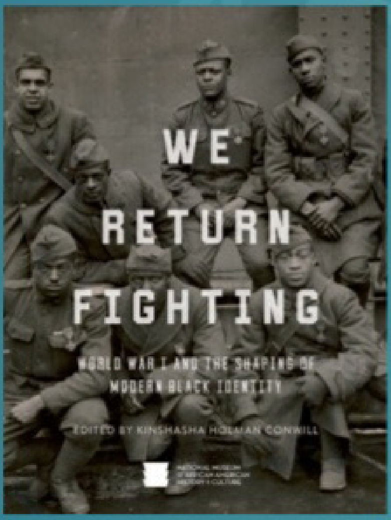
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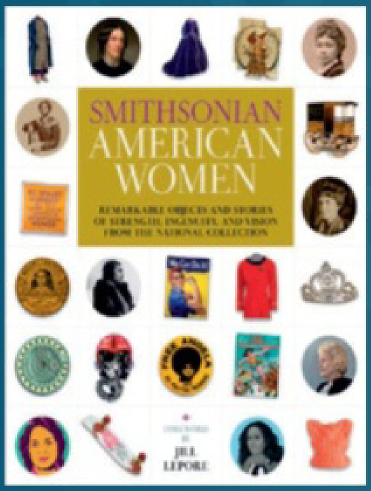
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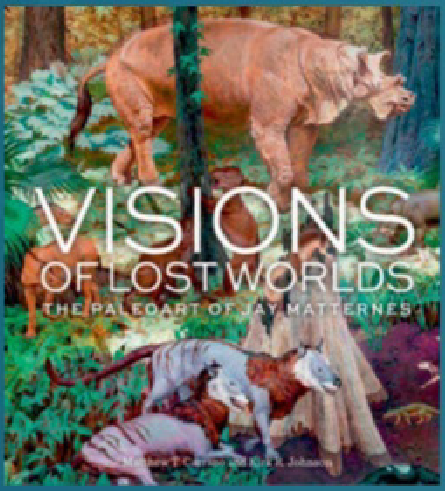
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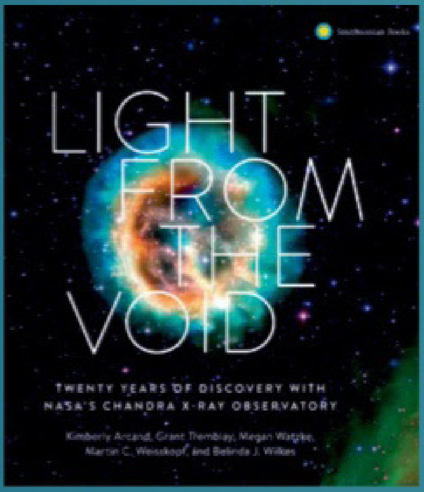
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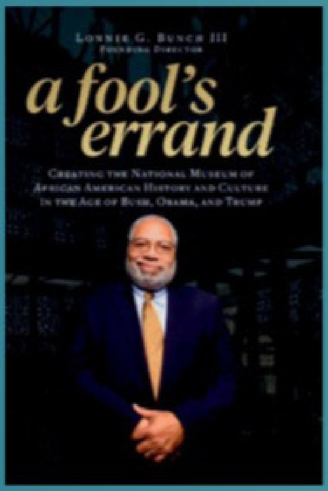
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prologue

AMERICAN ICON

By
Deb Amlen

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Block Party

New York-born word game rivets our attention a century later

AMERICAN ICON

Father of crosswords: The *New York World*'s Arthur Wynne came to the U.S. to pursue a career in journalism.

ON A BLUSTERY winter day in 1913, Arthur Wynne sat in his office at the *New York World* and wrestled with a problem. The Christmas edition of "Fun," the jokes and puzzles supplement he managed, was being laid out and Wynne felt readers needed a new challenge.

A Liverpool native, Wynne had emigrated to the United States at age 19, but before he did he might have seen some rudimentary word-form puzzles, which were popular in late 19th-century England. Perhaps inspired by those, as well as the "Sator" square, an ancient, five-word Latin palindrome, Wynne designed a numbered, diamond-shape grid with an empty center. He inserted "fun" at the top as the first "across" entry and called it "Word-Cross." Some of the clues required readers to know esoteric facts (apparently "nard" is an aromatic plant that grows mainly in the Himalayas), but others were puckish. An illustrator later accidentally changed "Word-Cross" to "Cross-Word," with no objection from Wynne, and the name stuck.

Thus Arthur Wynne is credited as the inventor of what is arguably the first mobile game—the American-style crossword puzzle, notable for its intellectual challenge and definitional yet amusing clues.

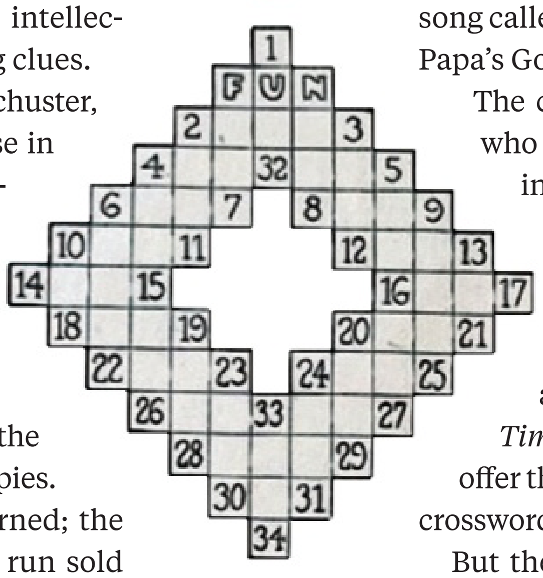
In 1924, Richard Simon and M. Lincoln Schuster, who had recently opened a publishing house in New York, honored the pleas of Simon's puzzle-loving aunt and printed a collection of crosswords, throwing in a free pencil to sweeten the deal. The first crossword puzzle book—an untested and decidedly nonliterary format—worried the firm so much that the firm's name did not appear on the book, which had a small printing of 3,600 copies.

The publisher needn't have been concerned; the book was an immediate success. The first run sold out quickly and the company ran additional printings. The book eventually sold more than 100,000 copies, perhaps spurred on by groups like the Amateur Cross Word Puzzle League of America, itself a creation of marketing-savvy Simon & Schuster.

The league began the process of standardizing the appearance of crosswords as early as 1924, instituting rules such as "all over interlock," which meant that no part of the grid could be completely cut off by the black squares; only one-sixth of the squares could be black; and the grid design had to be symmetrical. Other changes, like outlawing two-letter words, came later.

America had now tasted the satisfaction of creating order out of chaos, the Zen of making something from nothing. Solving crosswords could fairly be called a craze. The activity had become so prevalent that the *Times* of London decried it in an editorial called "An Enslaved America." Devotees spiced their conversation with obsolete words that were cropping up in crossword puzzles. There was even a 1924 song called "Cross-word Mamma You Puzzle Me (But Papa's Gonna Figure You Out)."

Unlike today's grids, Wynne's had no internal black squares. One clue asked, "What this puzzle is." Answer: "Hard."



The crossword fad, however, plagued librarians, who complained that puzzle "fans" were swarming the reference desk, clamoring for dictionaries and encyclopedias to help find answers, and pushing aside more "legitimate" readers and students.

Crosswords were now being published almost everywhere—except in the *New York Times*, the last major metropolitan newspaper to offer the puzzle. A 1924 editorial in the *Times* called crosswords "a primitive sort of mental exercise."

But the war that began for America in 1941 gave

SCIENCE HISTORY IMAGES / ALAMY; COURTESY WILL SHORTZ

crossword puzzles an important new function: escaping the woes of the news pages. Two weeks after the U.S. joined the hostilities, the *New York Times*' Sunday editor sent a memo to the publisher saying they "ought to proceed with the puzzle" to give readers something to do during those bleak blackout hours. To bolster his suggestion, the editor attached a letter from the crossword pioneer Margaret Petherbridge Farrar. "I don't think I have to sell you on the increased demand for this type of pastime in an increasingly worried world," she wrote. "You can't think of your troubles while solving a crossword."

The first *New York Times* crossword ran on Sunday, February 15, 1942, with Farrar as editor, and became a daily feature on September 11, 1950. Today the *Times*' puzzle—whose clues famously get trickier and more clever Monday to Saturday, with the hefty Sunday puzzle moderate in difficulty—is the one that most puzzle lovers aspire to conquer. Will Shortz, the *Times*' crossword editor for more than 25 years, says the fact that the puzzle appears in the *Times*, the country's newspaper of record, is significant.

The crossword world exploded in 2006 when the documentary *Wordplay* was released. A love letter to the die-hard puzzle solvers who religiously attend Shortz's American Crossword Puzzle Tournament—with appearances by celebrities like Bill Clinton and Jon Stewart, who like to solve the *Times*' crossword—it injected a bit of kooky glamour into the grids. Soon solving crosswords was a cool thing for young people to do, much as they are embracing other old pastimes like knitting.

But what kept people solving after they had their first taste of "cruciverbalism"? I like to think it was the humor and wordplay in crossword clues. My favorite clue? "It brings out the child in you." Answer: "Labor."

Nothing has had a bigger impact on the way we solve crosswords—or make them—than the internet. As online gaming became popular, puzzle makers realized solvers could get their daily fix on their computers and, eventually, their hand-held devices. The advent of online solving has encouraged independent puzzle makers like the American Values Club Crossword (AVCX) and the Inkubator.

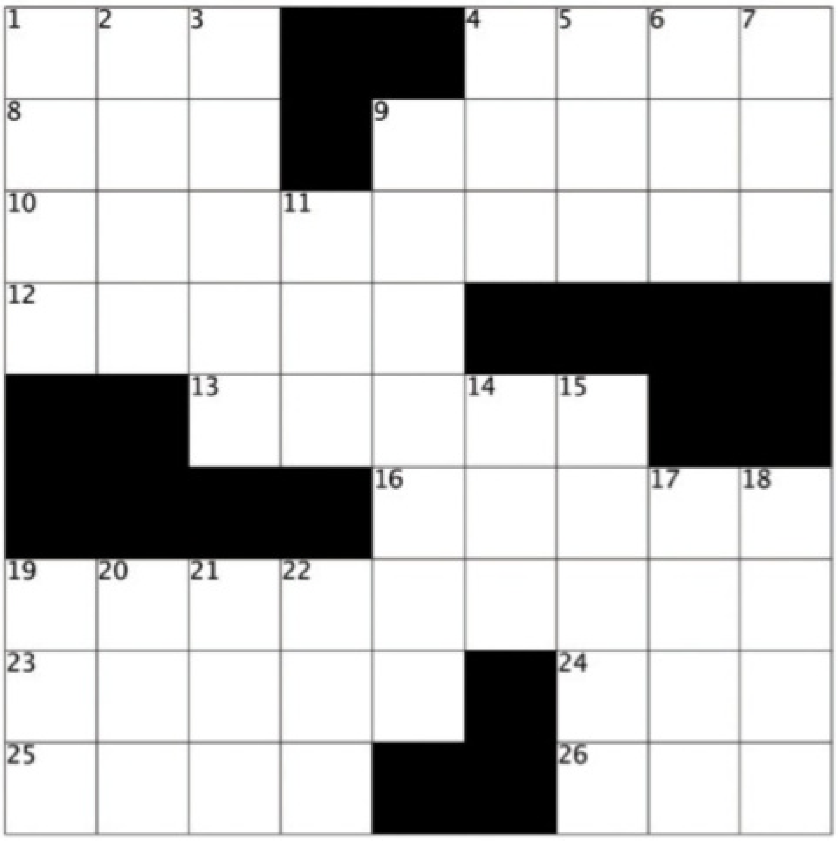
Whether solvers prefer putting pencil (or pen!) to paper or using their smartphones, all crossword publishers agree on one thing: The puzzles should "always be about good vibes," said Ben Tausig, the 39-year-old editor of the Queens, New York-based AVCX. "The content should be fun—a good laugh with no punching down." ◆

BYLINES **Deb Amlen** is crossword columnist and **Sam Ezersky** is associate puzzle editor of the *New York Times*.

Spellbound

PRESENTING THE FIRST CROSSWORD PUZZLE EVER PUBLISHED IN *SMITHSONIAN*. IT'LL BE OUR LAST—UNLESS READERS CLAMOR FOR MORE

By **Sam Ezersky**



WE ASKED ONE of the nation's top crossword constructors to build a puzzle around words found in articles in this issue. He picked seven. See the solution on Page 86.

ACROSS

1 "Too cute!"
4 Heidi Schreck's "What the Constitution Means to Me," for one
8 British bathroom
9 Color related to khaki
10 Like stepping in a chief's shadow, per ancient *kapu* tradition
12 Company with a "spokes duck"
13 Run out, as funding
16 Profanity-free
19 Formation of Rakhine insurgents in Myanmar
23 Having heard one's alarm go off, say
24 Genre for 26-Across
25 ___ therapy, treatment offered at St. Jude
26 "___ Town Road," #1 hit for Lil Nas X

DOWN

1 A, in the NATO alphabet
2 Sound heard at the pound
3 ___ Central Kitchen, nonprofit founded by José Andrés
4 ___ Xing (road sign)
5 Tupperware top
6 At least 35, for a U.S. president
7 Currency ... or craving
9 What did more to emancipate women than any one thing in the world, per Susan B. Anthony
11 Place to grab a drink
14 Diminutive suffix with "form"
15 Dog, in Spanish
17 Human rights lawyer Clooney
18 Big Apple law enforcement org.
19 Oil-soaked item at a body shop
20 Lamb's mother
21 Completely disallow
22 ___ out a living

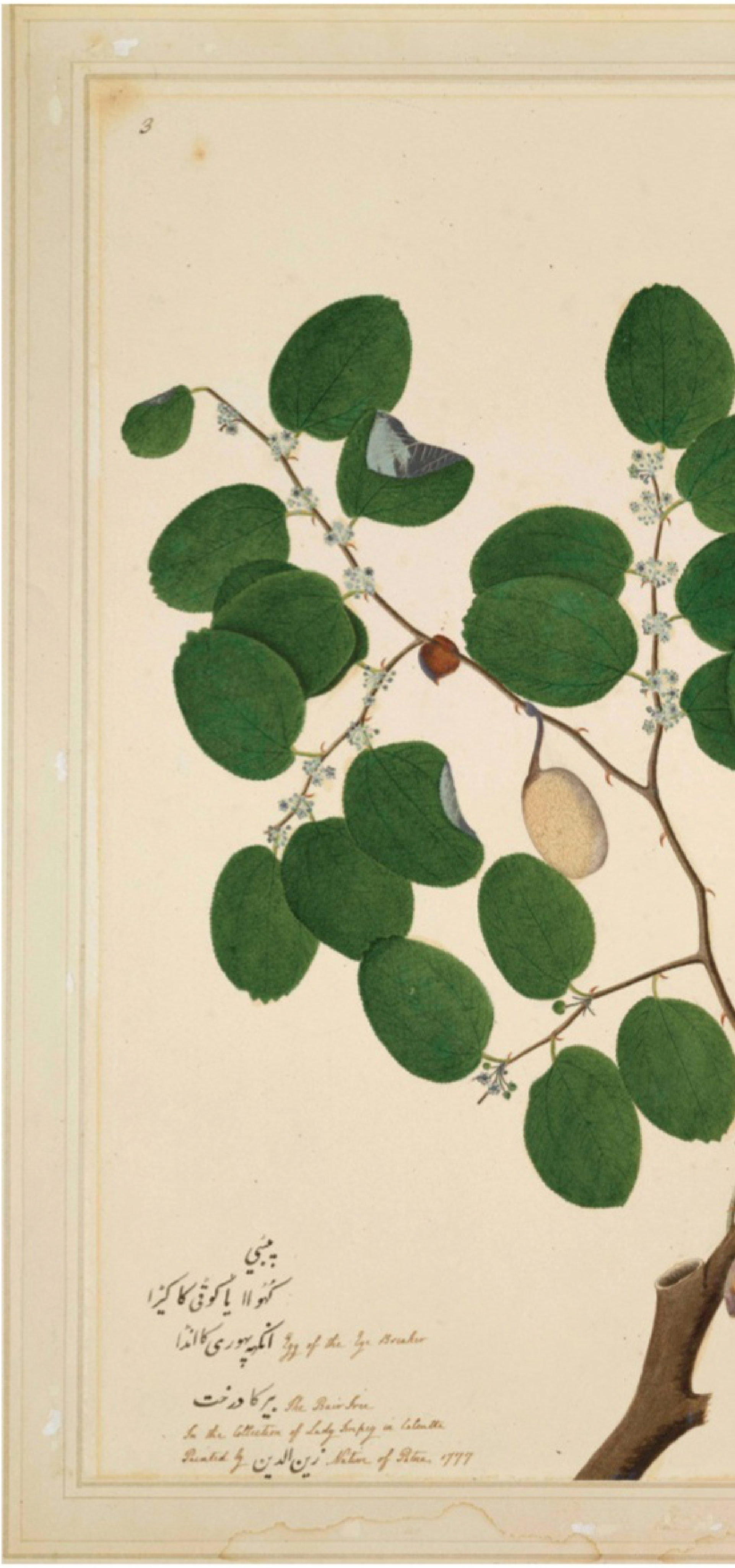
BEFORE AUDUBON

An 18th-century album of India's flora and fauna showcases the startling work of an overlooked master

IN THE LATE 1770S, a British colonial official named Sir Elijah Impey and his wife, Lady Mary, commissioned the Indian artist Shaikh Zain ud-Din to catalog a private menagerie, including various bird species, the couple had assembled at their home in Calcutta. Using paper and watercolors from England, Zain ud-Din, a Muslim from the city of Patna, modeled his work after English botanical illustration, but he also brought to the job his training in the ornate Mughal artistic tradition—and his own distinctive style. Today critics praise the quality of the colors and the composition, in which a bright, simple background offsets the keenly wrought details of plants and animals. "Everything is incredibly precise and beautifully observant," says Xavier Bray, director of London's Wallace Collection, which this month mounts the first UK exhibition of works by Indian artists commissioned by officers of the British East India Company.

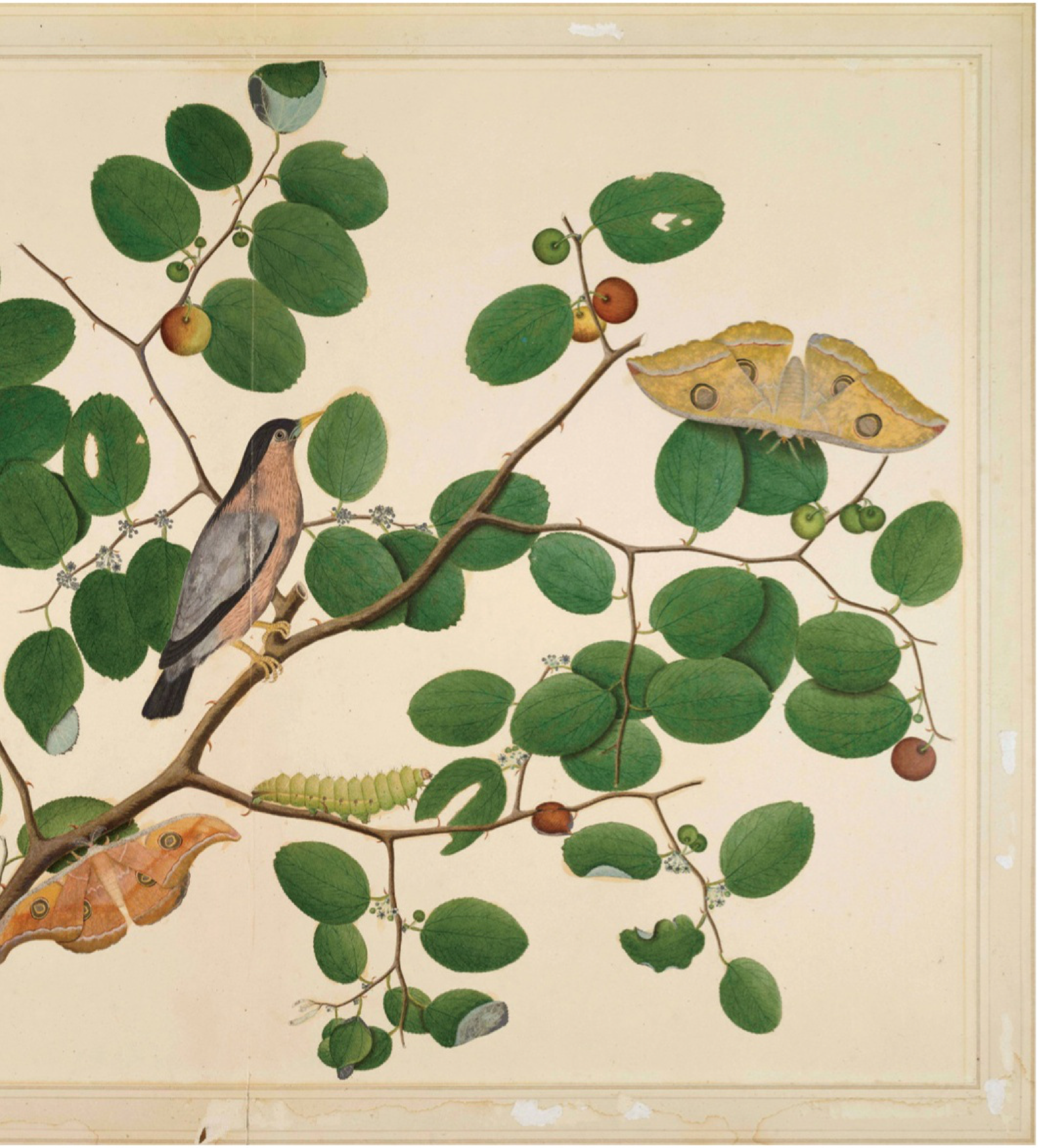
The expat aristocrats who patronized Zain ud-Din and his fellow artists had been sent abroad to help manage their country's growing empire, but once there many, like the Impeys, fell in love with the subcontinent, as well as its flora and fauna. "These paintings," Bray says, "were made into albums to be leafed through back home, on a rainy day, drinking Earl Grey tea."

History failed to record much about Zain ud-Din's life beyond his watercolors for the Impeys. But the new show, which includes 99 paintings of nature studies, portraits and landscapes by 18 artists, makes an argument that he and his contemporaries should be recognized on their own merits, as some of India's greatest painters. "Anything with a colonial air about it is now considered politically incorrect," Bray says. "But what we're trying to do is bring back these extraordinary artists who have been almost completely forgotten." ◆


3
انکھ پھوری کا انڈا
Egg of the Eye Breaker
بیر کا درخت
The Bair Tree
In the Collection of Lady Impey in Calcutta
Painted by زین الدین Native of Patna 1777

By
Amy Crawford

Shaikh Zain ud-Din's *Brahminy Starling with Two Antheraea Moths, Caterpillar, and Cocoon on an Indian Jujube Tree* was originally part of an album commissioned by his British patrons.



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TECHNOLOGY

By
Clive Thompson

Illustration by
Kotryna Zukauskaite

When Two Wheels Are The Rage

Bicycles revolutionized personal transport—and led to surprising societal change. Will the electric scooter invasion do the same?

I**T WAS A HOT SUMMER DAY** in Hoboken, New Jersey, and the streets were buzzing with electric scooters.

Two months earlier, the companies Lime and Ojo had unleashed 300 of the devices on the town. You could pay $1 or more to unlock a scooter with your mobile phone, then 10 to 29 cents per minute to ride it, leaving it parked on the sidewalk or docking station when you were done. By July, you couldn't go a block without seeing riders zip by: young women in sundresses, a couple heading downtown to catch a train, two men in athletic wear, squash rackets slung over their shoulders. "You gotta hold on tight," one rider, a young man coiffed scruffily and wearing sunglasses, advised me, "because these things take off when you hit ➔

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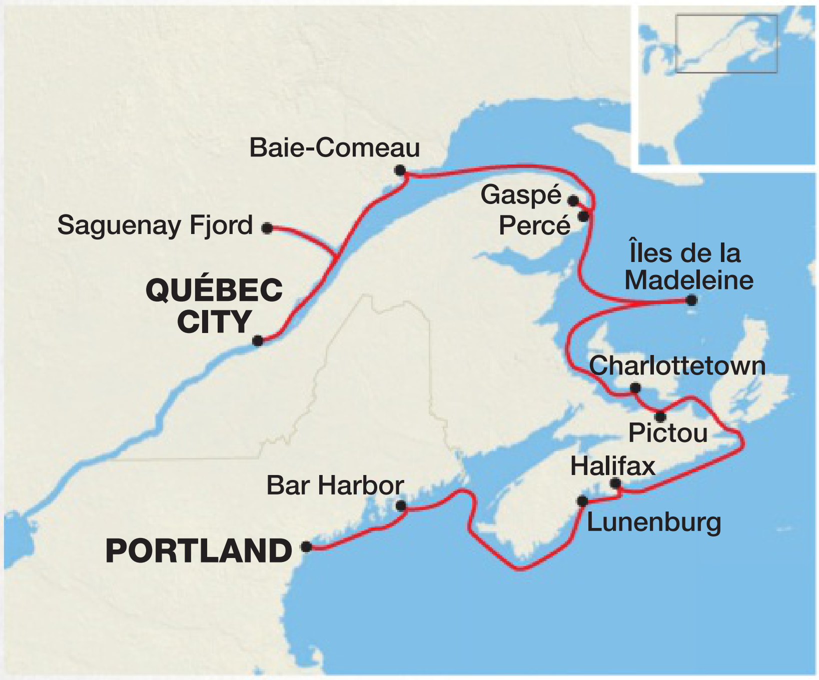
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Last year Americans took more than 38 million electric scooter trips in 100 cities. Many scooters, like the Lime-S, can travel as far as 20 miles on a single charge.

GETTY IMAGES

the throttle. Sixteen miles an hour! It'll throw you!"

E-scooters are part of a wave of "micromobility" companies that have arrived, seemingly overnight, in U.S. cities, plopping down thousands of electric bikes and scooters. Fans swear by them, arguing that the scooters let them take fewer car rides, saving money and reducing carbon dioxide emissions, while opening up parts of the city they might otherwise never go to. Plus, "they're just so much fun," one Hoboken woman gushed.

"Micromobility is solving the last-mile problem," of traveling short distances when public transit and cabs aren't convenient, says Euwyn Poon, president and co-founder of Spin, a division of Ford that offers dockless electric scooters.

But the kudzu-like growth of scooters has also tangled urban life. City officials complain the firms don't manage the behavior of riders, who are generally not supposed to ride on sidewalks but frequently do, enraging pedestrians (and sometimes plowing into them). Riders are also supposed to park scooters neatly upright, but when some are inevitably strewn about on sidewalks, they become an obstacle. And on America's badly maintained roads, fast-moving scooters aren't terribly stable, and the companies don't provide helmets with each ride. Hitting a bump or pothole can send riders flying, knocking out teeth or even causing traumatic head injuries.

Furious citizens are now vandalizing the devices nationwide: Behold the Instagram feed "Bird Graveyard," devoted to images of Bird scooters and their kin poking mournfully out of riverbeds, where they've been hurled, or buried handlebar-deep in sand. "Those things are a straight-up public menace," fumed one Hoboken resident on Twitter. Some city politicians are trying to ban the scooters altogether.

It's a messy rollout, pun intended. The last time we saw an intense debate like this over a curious new form of personal transportation that suddenly descended on cities and angered pedestrians was a century ago, and the "micromobility" in question was the bicycle.

IT TOOK INVENTORS about 70 years to perfect the bicycle. An ur-version was built in the 1810s by the German inventor Karl von Drais, and it was just two wheels on a frame. You scooted along by pushing it, Flintstones-style, with your feet. "On a plain, even after a heavy rain, it will go 6 to 7 miles an hour, which is as swift as a courier," Drais boasted.

By the 1870s, entrepreneurs were putting pedals on the front wheel, creating the "velocipede" (the Latin roots for "fast foot"). Since a bigger wheel went faster, inventors built front wheels as huge as five feet tall, stabilized by a tiny back wheel—a "penny farthing," as the cycle was known. Riding was mostly a sport of well-off young men, and riders exulted at the dual feelings of speed and height. "From the saddle we perceive things which are hidden from them who only walk upon the earth," one Connecticut rider boasted in 1882. "We dash across the plain with a wild sense of freedom and power which no one ever knows until he rides the magic steed."

From the very beginning, though, riders were also mocked as fops pursuing a ludicrous pastime. Pedestrians back then were the prime users of roads and sidewalks, so cycles seemed like dangerous interlopers. A Baltimore newspaper called the bicycle "a curious two-wheeled device . . . which is propelled by jackasses instead of horses." One New Haven, Connecticut, newspaper editorial even encouraged people to "seize, break, destroy, or convert to their own use as good prize, all such machines found running on the sidewalks." As long ago as 1819, a New York man wrote a letter to a newspaper complaining that you "cannot enjoy a walk in the evening, without the danger of being run over by some of these new-created animals."

In truth, the bikes were arguably more dangerous to the riders themselves. Hit a bump and you might find yourself "taking a header"—a coinage of the time—by flying over the high front wheel. "Plenty ➔

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12

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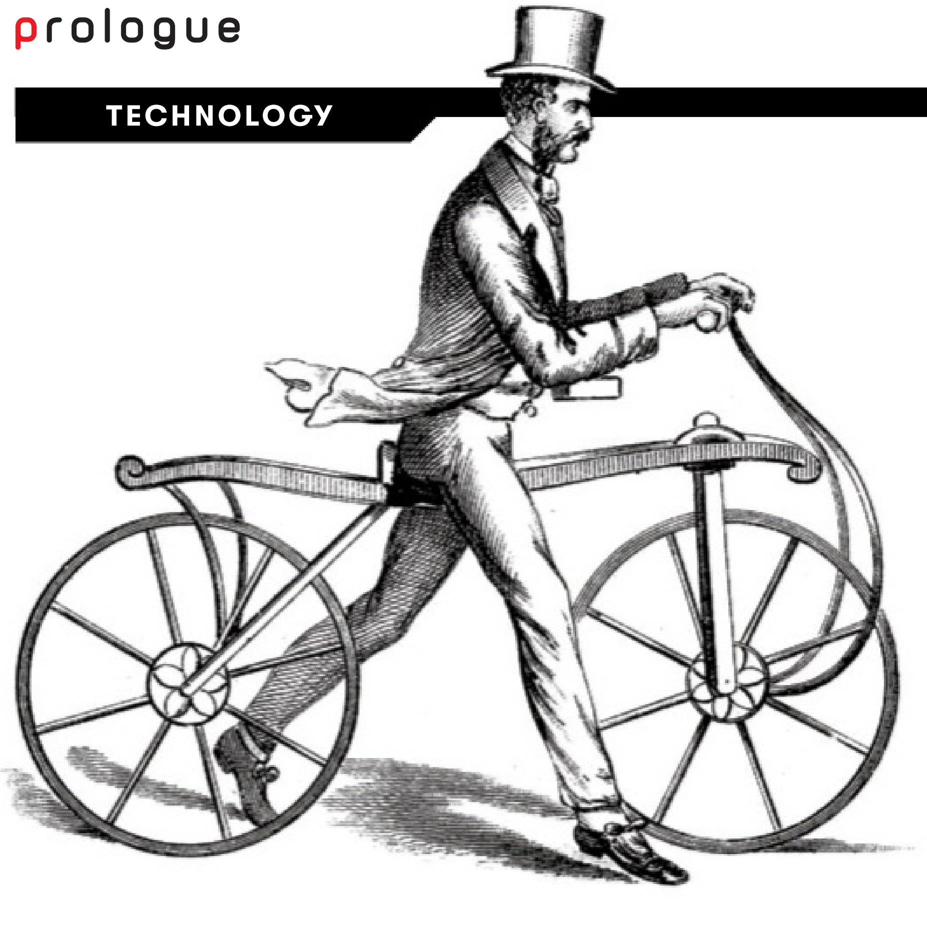

GETTY IMAGES

Invented in 1817, the "dandy horse" had no pedals or brakes. It required riders to use their feet to propel it along or skid to a stop.

of people died riding penny farthings," notes Michael Hutchinson, a bike racer and author of *Re:Cyclists*, a history of cycling.

The bicycle didn't truly reach the mainstream until engineers began selling the "safety" bike in the 1890s. With inflatable tires, it offered a gentler, less bone-shaking ride, and the chain propelling the back wheel left the front free for steering. Now *this* was something anyone could ride—and anyone did, as dozens of bike firms flooded the market. The bicycle craze was born.

"People were buying a new bike every year, they wanted to have the latest model—it was like the iPhone today," says Robert Turpin, a historian at Lees-McRae College and author of *First Taste of Freedom*, a study of early bicycle marketing. Bicycle ads flourished and Americans devoured bicycling magazines. "There were daily bicycling print publications," marvels Sue Macy, author of *Wheels of Change*.

Cyclists took to city parks, or fled crowded urban areas. Some challenged themselves to ride 100 miles in a day. Clubs formed for outings and races, and long-disused roadhouses were rehabilitated to service cyclists on long journeys. "Everything is bicycle," as the author Stephen Crane quipped.

To many, cycling embodied the very spirit of American freedom and equality. "As a social revolutioniser it has never had an equal," *Scientific American* observed in 1896. "It has put the human race on wheels, and has thus changed many of the most ordinary processes and methods of social life. It is the great leveller." By 1900, there were more than 1.25 million cyclists in the United States.

Conflict ensued. Horses, in particular, would bolt or panic at the approach of a madly pedaling cyclist. Some livery drivers fought back by deliberately running over cyclists, or spitting tobacco at them. Pedestrians got in fistfights with cyclists who collided with them, or even pushed them into the path of oncoming trolley cars. "With park guards unfriendly, and policemen openly hostile," the *New York Sun* noted, cyclists had plenty of opposition. New York's city council banned bikes from public parks; in retaliation, the founder of the country's biggest bicycle firm encouraged three cyclists to deliberately break the law so he could mount a court challenge.

Initially, doctors fretted that cycling would cause health problems, such as "bicycle face," a rictus supposedly caused by holding your mouth in grimace and your eyes wide open. "Once fixed upon the countenance, it can never be removed," a journalist soberly warned. Or beware "kyphosis bicyclistarum," a permanent hunching of the back, acquired from bending over the handlebars to go faster. Soon, though, these quack diagnoses faded; it was obvious that cycling improved health. Indeed, doctors advised cycling to help exercise the increasingly sedentary, desk-bound office workers of the new industrial economy.

ANOTHER BIG SOCIAL CHANGE the bicycle wrought was in the lives of middle-class American women. In the Victorian period up until then, geographically speaking, "their lives were very circumscribed—they were supposed to stay home and take care of the family," notes Margaret Guroff, author of *The Mechanical Horse: How the Bicycle Reshaped American Life*. Traveling far under their own steam wasn't easy for young middle-class women, given that they wore heavy petticoats and corsets.

Riding a bicycle felt like a burst of independence. "Finally you could go where you wanted, on your own," Macy says. "When you were riding a cycle your mother didn't know where you were!" Young women could meet potential paramours on the road, instead of having their parents size them up in their living room. Soon women were 30 percent of all cyclists, using the newfangled technology to visit friends and travel the countryside. It was empowering. "Cycling is fast bringing about this change of feelings regarding women and her capabilities," the *Minneapolis Tribune* wrote. "A woman awheel is an independent creature, free to go where she will."

It even changed clothing. Feminists had long promoted the "rational dress" movement, arguing that women should be allowed to wear "bloomers," blousy pants; but it had never caught on. Bicycles, though, made the prospect of wearing "bifurcated raiment" newly practical. Skirts got caught in ➔

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wheels. By the 1890s, a women in bloomers on a bicycle was an increasingly common sight.

"I'll tell you what I think of bicycling," the suffragist Susan B. Anthony said in 1896. "I think it has done more to emancipate woman than any one thing in the world."

ELECTRIC SCOOTERS ARE unlikely to pack such a powerful social punch. But proponents argue that they could lower emissions in cities—if they become ubiquitous and residents use them both to supplant trips in cars and to augment spotty public transit. "People are looking for alternatives," says Lime executive Adam Kovacevich.

City officials can be dubious, though, given the chaos that has accompanied the arrival of scooters. For example, Nashville allowed the firms to set up shop in 2018, but a year later, after seeing scooters strewn about and accidents, Mayor David Briley "believes that scooters have been a failed experiment," a City Hall spokesman told me in an email. Briley proposed banning them; the city council voted to halve the number instead—from 4,000 to 2,000—and asked the scooter firms to manage their customers better. Atlanta banned them at night. Public opinion seems bimodal: People either cherish or despise them. A few riders told me they started as fans, only to change their minds after experiencing terrible accidents—including one woman I emailed who spent months recovering from brain damage.

Are these just growing pains, like those that accompanied the rise of the bicycle? Possibly: It took years for protocols and regulations on bike-riding to emerge—though one difference today is the on-demand scooters are deployed not by individual owners, but by huge, high-tech firms seeking to blanket the city and grow rapidly.

CONTINUED ON PAGE 86

Hulking Airships Rise Again, Slowly

A WORLD IN A HURRY TURNS TO A LUMBERING EARLY 20TH-CENTURY TECHNOLOGY FOR A LESSON IN EFFICIENCY

By **April White**

U.S. NAVY
ZEPPELIN

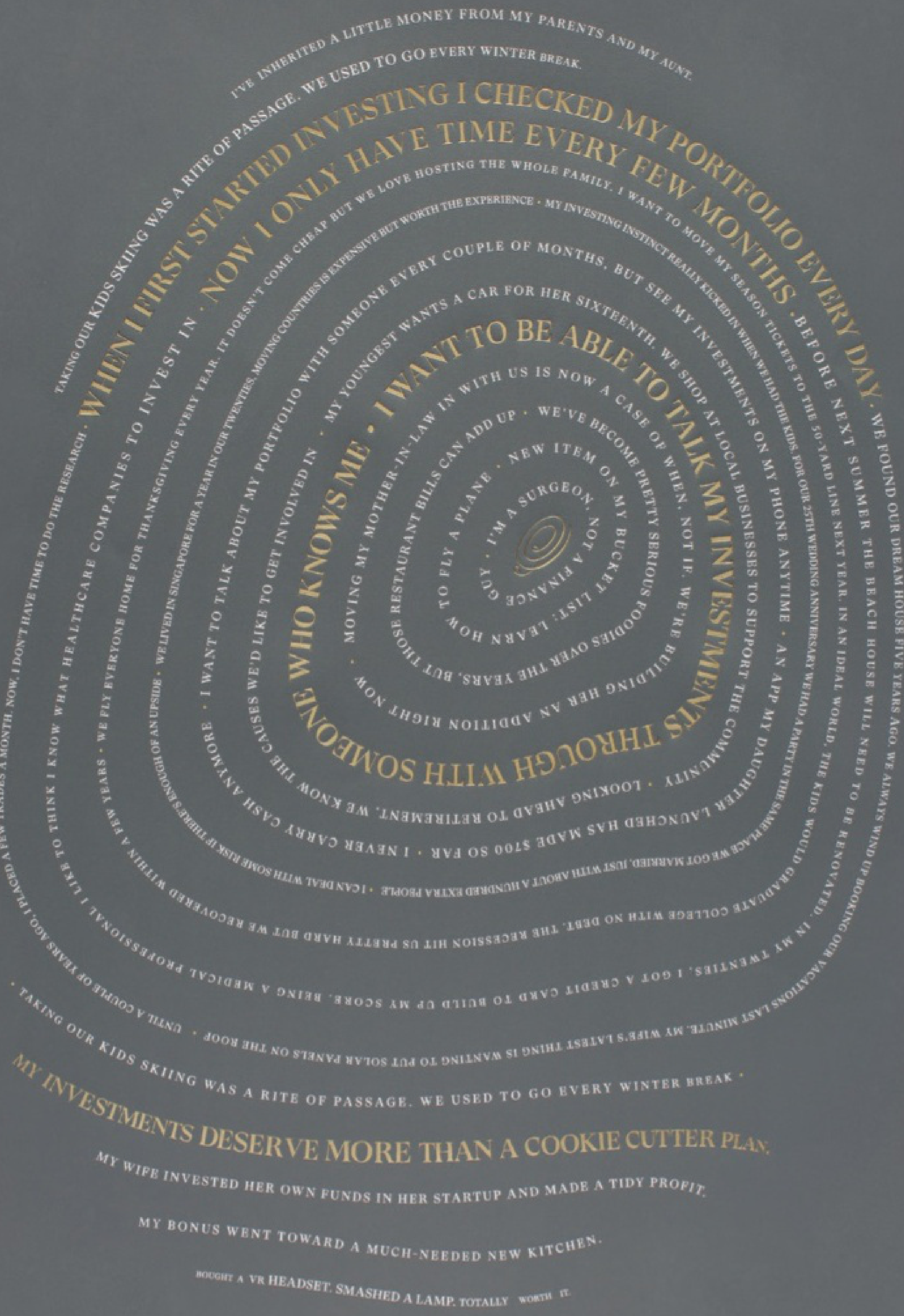
IN THE 1930S, before commercial airplanes began crossing the Atlantic, zeppelins promised to change how we traveled. They could make the voyage in just 43 hours, while the fastest ocean liner took five days. But when the *Hindenburg* plummeted from the New Jersey sky in 1937, killing 36 people, the disaster also ended the dream that hydrogen-filled airships would be the future of transportation.

Now scientists and others are starting to look at zeppelins as something more than hovering billboards like the Goodyear Blimp. The reason is a benefit that went unrecognized a century ago: Airships can be more fuel efficient than cargo ships and airplanes.

Most modern airships use helium, a nonflammable but expensive and rare gas. But technological advances have lessened the explosive danger associated with hydrogen, which is endlessly abundant. So the military, space agencies and others are stepping up research on hydrogen-filled airships. And cargo transport could be speedy as well as efficient. A new study in the journal *Energy Conversion and Management* found that an airship five times the length of the Empire State Building riding the jet stream could circle the globe in 14 days—faster than any oceangoing ship. ◆

▲ Top, the Navy's short-lived USS *Macon* in 1933; above, a commercial passenger airship in 2014.

U.S. NAVY; ACHIM MENDE / ZEPPELIN


I'VE INHERITED A LITTLE MONEY FROM MY PARENTS AND MY AUNT.
TAKING OUR KIDS SKIING WAS A RITE OF PASSAGE. WE USED TO GO EVERY WINTER BREAK.
WHEN I FIRST STARTED INVESTING I CHECKED MY PORTFOLIO EVERY DAY.
NOW I ONLY HAVE TIME EVERY FEW MONTHS.
I WANT TO BE ABLE TO TALK MY INVESTMENTS THROUGH WITH SOMEONE WHO KNOWS ME.
I'M A SURGEON, NOT A FINANCE GUY.
MY INVESTMENTS DESERVE MORE THAN A COOKIE CUTTER PLAN.
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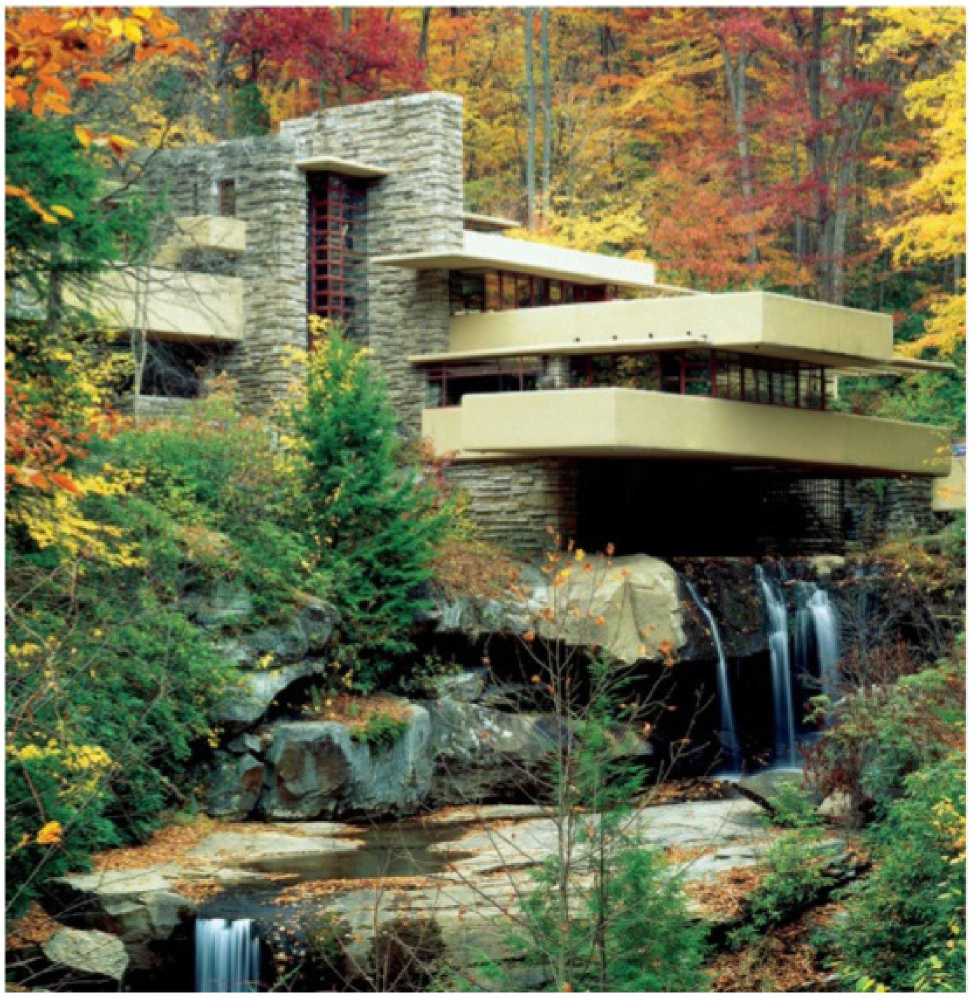
ARCHITECTURE

By
Paul Hendrickson

IN THE AMERICAN GRAIN

Searching for the essence of the prickly, brilliant, deeply influential Frank Lloyd Wright



No structure epitomizes Wright's "organic" approach like Fallingwater, the 1937 house in Pennsylvania. Unesco designated it a World Historic site this past July.

ALAMY

FRANK LLOYD WRIGHT, the greatest architect this country has yet produced, was born two years after the end of the Civil War and died not quite two years after the launch of *Sputnik*—91 years and 10 months on the earth. In his cape and porkpie hat and those goofy pants (almost pantaloons) that were pegged at the ankles, he strutted through our national imagination for something like a seven-decade career. His work has been built over three centuries—19th, 20th and 21st. (I know, it reads like a typo, but I'm referring to the handful of posthumous works that, for one reason or another, didn't get around to being built until long after his death in 1959.)

In his 72-year career as an architect and egotist, Wright managed to design more than 1,100 things, a staggering number by any artistic measurement.

They were churches, schools, offices, banks, museums, hotels, medical clinics, an automobile showroom, a synagogue, a mile-high skyscraper—and one exotic-looking Phillips 66 gas station in Cloquet, Minnesota. Overwhelmingly, though, they were houses, shelters for mankind, and by that fact alone, I think there is something slyly to be said about his fundamental decency as a human being. By no means did all of it get built. Not quite half of all his drawings and designs and studies were realized, and a little more than 400 still come magically out of the American ground looking for the light: Fallingwater near Pittsburgh, the Guggenheim Museum on Fifth Avenue, the Johnson Wax Building in Racine, Wisconsin, Unity Temple in Oak Park, Illinois, Robie House on the campus of the University of Chicago—to cite just five masterworks by their vernacular names.

One of Wright's nearly lifelong dictums was that his buildings were like shrubs and trees, growing upward, in effect, from the inside out, emerging spanking-wet and blinking their eyes to the world. (OK, that's a different metaphor.) It was all part of his gospel of "organic architecture," even if his definitions of that concept were always shifting around, like verbal tectonic plates, and sometimes seemed to mystify even him. It was as if he knew what he meant, or at least felt, even if you didn't know, and even if in some ultimate spiritual and intellectual sense he didn't really know, either. He didn't need to know. He just needed to conceive the thing, draw the thing, and make the thing. "The thing had simply shaken itself out of my sleeve," the old shaman liked to say, ever his own best publicist.

Shelters for mankind—from the almost impossibly grand to the utilitarian bare and spare and functional, and all the more beautiful for such simplicity and environmental purity. (He had a term for this latter kind of house, which I so deeply love—"Usonian.") The interior of a Frank Lloyd Wright house, whether a great ship on the prairie or just a little birdlike jewel you swear you could nest in your palm, is always about many things, but at the center of each one is the intertwined idea of openness and flow. No matter what else he did with the design of a house in his nearly three-quarters of a century as a revolutionary architect, whether hanging it on the lip of a waterfall in Pennsylvania or ➔

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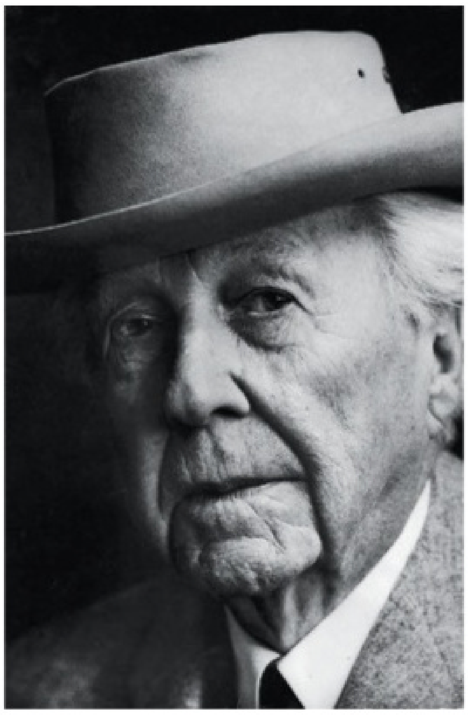
sticking it miragelike in the middle of a desert in Arizona, he was out to “break the box,” to destroy forever those tight, draped, dark, horsehair, closed-off, Victorian rooms of our 19th-century forebears. He wanted to let light in and space in, air in, life in. And he did so, radically. Evangelically. It was a way of thinking and feeling he never let go of. He did it initially, and most radically, in his “Prairie Houses,” in and around the turn of the 20th century, which alone are enough to have made him immortal. The esteemed contemporary architecture critic Paul Goldberger once put it this way in regard to Wright: “He really did feel that America, as this new democratic country . . . needed a new architectural expression . . . that was horizontal, open in plan, open across the landscape, a sense somehow that it was connecting to that great open American land. . . . He saw that American landscape, the openness of it, the sense that it was always moving across the land, pushing westward.”



Wright was “one of the most creative architectural geniuses of all time,” the critic Lewis Mumford wrote, though each building “stands in self-imposed isolation.”

Throughout his life Wright himself tried to articulate what he was doing in terms of this interlocking idea of openness and harmonious flow as it connects to the larger idea of freedom and indeed to the still larger idea of America itself. Six years before he died, he wrote:

“To say the house planted by myself on the good earth of the Chicago prairie as early as 1900, or earlier, was the first truly democratic expression of our democracy in Architecture would start a controversy with professional addicts who believe Architecture has no political (therefore no social) significance. So, let’s say that the spirit of democracy—freedom of the individual as an individual—took hold of the house as it then was, took off the attic and the porch, pulled out the basement, and made single spacious, harmonious unit of living room, dining room and kitchen, with appropriate entry convenience.”

IT’S ALMOST IMPOSSIBLE to step inside any Wright work, but especially his houses (and mind you, he always tended to think of them as his houses, hell with the client), and not get something of this ineffable feeling of openness and freedom that somehow seems greater than the (beautiful) building itself. There are certain moments, standing in such spaces, if the light is falling right, when it will begin to seem as if Whitman is singing to Emerson, or vice versa, channeled through an ego that could see both of theirs in the great stakes game of fame and self-love, and raise it by half. There are also moments when what comes, as others before me have said, is the wonder of a religious feeling.

What comes to me, I suppose, not every time, but often enough, is the glad idea of my Americanness, and not in any corny or jingoistic way. For all the terrible dross and refuse of his ego and arrogance, this confounding man and supreme artist left us with something essential that helps define us as Americans, or so I believe.

(Although let it be said: He wasn’t the first. His mentor, the great Louis H. Sullivan, from whom Wright learned more about architecture than from any other person, was always way out ahead of the pupil on the gospel of creating an American architecture for Americans. Wright gets too much credit for that idea, not that he didn’t understand the gospel in deeper ways than Sullivan or raise it to far more brilliant levels. But the dream didn’t originate with him: just one more instance of the lifelong capacity for smooth appropriating.)

This feeling I am trying to pin down, the ineffable aspect, the American aspect, the sea-to-shining-sea democratic aspect, comes to me almost every time I go back to my hometown of Kankakee, Illinois, and stand quietly before the B. Harley Bradley House. It is my boyhood Frank Lloyd Wright, the one I first saw circa 1953 on a J.C. Higgins maroon three-speed. (The bike was under the Christmas tree that year.) The Bradley is the precursor Prairie, the St. John the Baptist Prairie. It came right at the light of the new century, 1900. Every time I go back, I am awed again by its interior gleams and quarter-sawn-oak angularities and sheltering eaves and narrow bands of glittering art-glass windows, but not least awed by its uncanny interflowing spaces. Yes, he broke the box. Heck, I wonder if I even really knew the name Frank Lloyd Wright in 1953. I was just a downstate Catholic kid pedaling past an American wonder with the wrist strap of my Spalding ball glove hooked to my handlebars. This century on, the Bradley is there, on the same street that I once lived on, South Harrison Avenue, haunting my imagination. ◆

Adapted from Plagued by Fire: The Dreams and Furies of Frank Lloyd Wright. *By Paul Hendrickson. Just published by Alfred K. Knopf. Copyright © 2019.*

BYLINE **Paul Hendrickson**, the author of numerous books, teaches writing at the University of Pennsylvania.

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Royal Family Feud

A feathered cape worn by a Hawaiian chief two centuries ago tells a story of human conflict and ecological tragedy

By
Paul Theroux

Photograph by
Cade Martin

FROM THE SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY

THIS MAJESTIC FEATHER cloak is a trophy from a bloody battle, fought two centuries ago by two cousins with opposing views, a conflict that decided forever the cultural fate of Hawaii. One cousin, Liholiho—Kamehameha II—was determined to end the ancient *kapu* system that regulated traditional customs, the veneration of gods, the conduct of eating and much else. The other cousin, Kekuaokalani, was a traditionalist; to him, it is said, even a chief's shadow was sacred and anyone who stepped into it must be killed. The ai kapu—the eating taboo—was also severe; women were forbidden to eat bananas, for example, among other things. But the kapu had endured for centuries. It ordered Hawaii society, it conferred respect, it is related to our word "taboo."

The dispute over this belief system became a battle that was fought at Kuamo'o, near Kona on the Big Island of Hawaii, toward the end of December 1819. Kekuaokalani was wearing the feather cloak, a sanctified symbol of his prestige. He was mortally wounded, and at his death on the battlefield the cloak was stripped from him by the victors. His wife, Manono, fought furiously and died beside him.

But even decisive battles are never so simple. This one would probably never have been fought in the way it was if foreigners from America, England, France and Russia had not gone to Hawaii as plunderers, advisers and traders—influential, not to say subversive, in their habits, swaggering through the islands, questioning the kapu, indifferent toward the gods, boasting of their firepower and their ironmongery. Most of these foreigners were in search of sandalwood, the fragrant timber that they sold for high prices to Chinese traders in Canton.

Money did not figure in these sandalwood transactions; firepower and iron took its place. Capt. James Cook had established the tradition. In February 1779, when Cook took a fancy to an extravagant red feather cloak that Liholiho's father, Kamehameha the Great, was wearing, the king handed it over to the English voyager in exchange for seven iron daggers.

The sandalwood traders offered "Brown Bess" muskets, pistols, ammunition, swords, powder and flints. According to the British Royal Navy explorer George Vancouver, who would visit the islands in the 1790s, and others, the rifles were of inferior quality, antiquated and unreliable. But clashes in the islands, among rival clans and chieftains, boosted the trade in armaments, turning Hawaiian society into a gun culture.

"In view of the strife of contending chieftains," Ralph Kuykendall writes in his definitive work, *The Hawaiian Kingdom*, "it is not strange to find in the contemporary literature of the period repeated references to the efforts of the chiefs to obtain cannons, muskets, and ammunition.... Captain Douglas in the spring of 1789 supplied Kamehameha with a quantity of arms and ammunition, including a swivel gun mounted on the platform of a large double canoe."

Kamehameha's son Liholiho inherited a substantial arsenal, as did Kekuaokalani. So it's not surprising that the battle of Kuamo'o was a bloody one, blazing with cannon fire and the crack of pistols and muskets, as well as the thump of sling stones, and spears, the clash of iron daggers and undoubtedly on the traditionalist's Kekuaokalani's side, the consecrated *leiomano*, the shark-toothed club favored by the god of war.

The battle itself was waged over a number of days in a series of skirmishes, both in Kuamo'o and on the nearby sea, warriors fighting from their canoes with firearms, spears and stones—including a swivel-gun on a double-hulled canoe, possibly the one acquired in trade 30 years earlier. Historians estimate the dead in the hundreds. Today, the Hawaiian cultural preservation group Aloha Kuamo'o Aina, steward of the historic battlefield, promotes the view that, "With her dying breath, Chiefess Manono is said to have uttered *Malama ko aloha*—keep your love—a plea to both sides that no matter what obstacles come to Hawaii, keep your love for one another."

The cloak was taken, and the bodies of Kekuaokalani and Manono and their fallen piled with stones. The old gods were overthrown, there was no veneration. But—behold!—three months after this battle, in March 1820, the first missionaries arrived from New England, with Holy Bibles and a new god to worship.

The cloak, donated to the Smithsonian in 1947 by Princess Kawananakoa, bears exquisite feathers plucked from fabulous birds that were prolific all over Hawaii. The black feathers are possibly from the black O'o, the red perhaps from the Scarlet Hawaiian honeycreeper, but in any case the O'o, and scores of other Hawaiian birds, are extinct, the most melancholy feature of this beautiful thing. ◆

TO LISTEN TO *authentic Hawaiian music from Smithsonian Folkways, go to* ***Smithsonianmag.com/feathercloak***

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▲ A device circa 1970, when it was still strange for people to talk to machines.

Origins

On Hold

HOW A TELEPHONE MONOPOLY AND A FEAR OF WIRETAPPING HUNG UP THE ANSWERING MACHINE FOR DECADES

By **April White**

IN THE SPRING of 1900, twenty-four years after Alexander Graham Bell introduced the telephone, a Danish inventor named Valdemar Poulsen unveiled the "telegraphone" at the Exposition Universelle in Paris. It was an engineering marvel—Poulsen recorded sound on a wire using nothing but a magnet, similar to the principle that underlies computer hard drives—and it was a minor social miracle, an antidote to Bell's constantly ringing telephone. The telegraphone was the world's first answering machine.

"It is easy to see that such an apparatus would be a great convenience, especially for a man of business," opined the *London Daily News*. "The experts present professed astonishment at what it can do," the *New York World* announced following tests in the United States.

Not everyone was overjoyed. AT&T, which held a monopoly on the U.S. phone system and forbid the use of third-party technology, suppressed the innovation for more than half a century, according to research by Mark Clark, a historian of technology. "If at any time there was a reasonable probability that such a device was connected at one end or the other . . . it would greatly restrict the use of the telephone," an AT&T executive wrote in 1930.

A big concern was that the device would be used not just to answer calls but to record conversations. The American Telegraphone Company, which had attempted unsuccessfully to market the machine, claimed that AT&T feared the device's ability to record calls. It would deter "illegitimate uses of the telephone in corrupt business schemes and in social duplicity"—thus depriving the phone company of up to a third of its business.

Meanwhile, AT&T scientists were building their own version of the answering machine. For six months in 1934, callers to Bell Laboratories were greeted by a recorded message and prompted to leave their own. But it would be another 17 years before AT&T offered the technology to its customers. ◆

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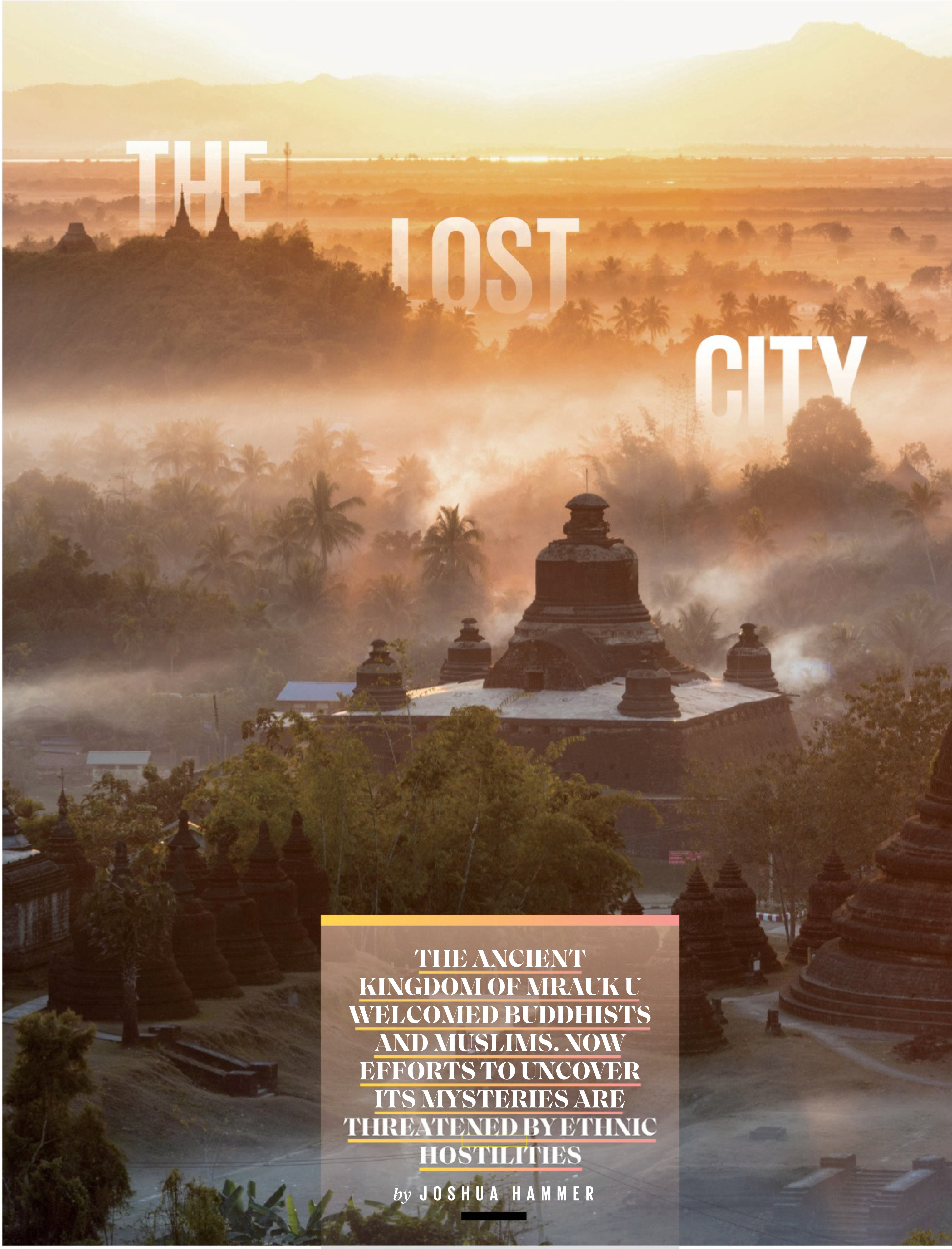
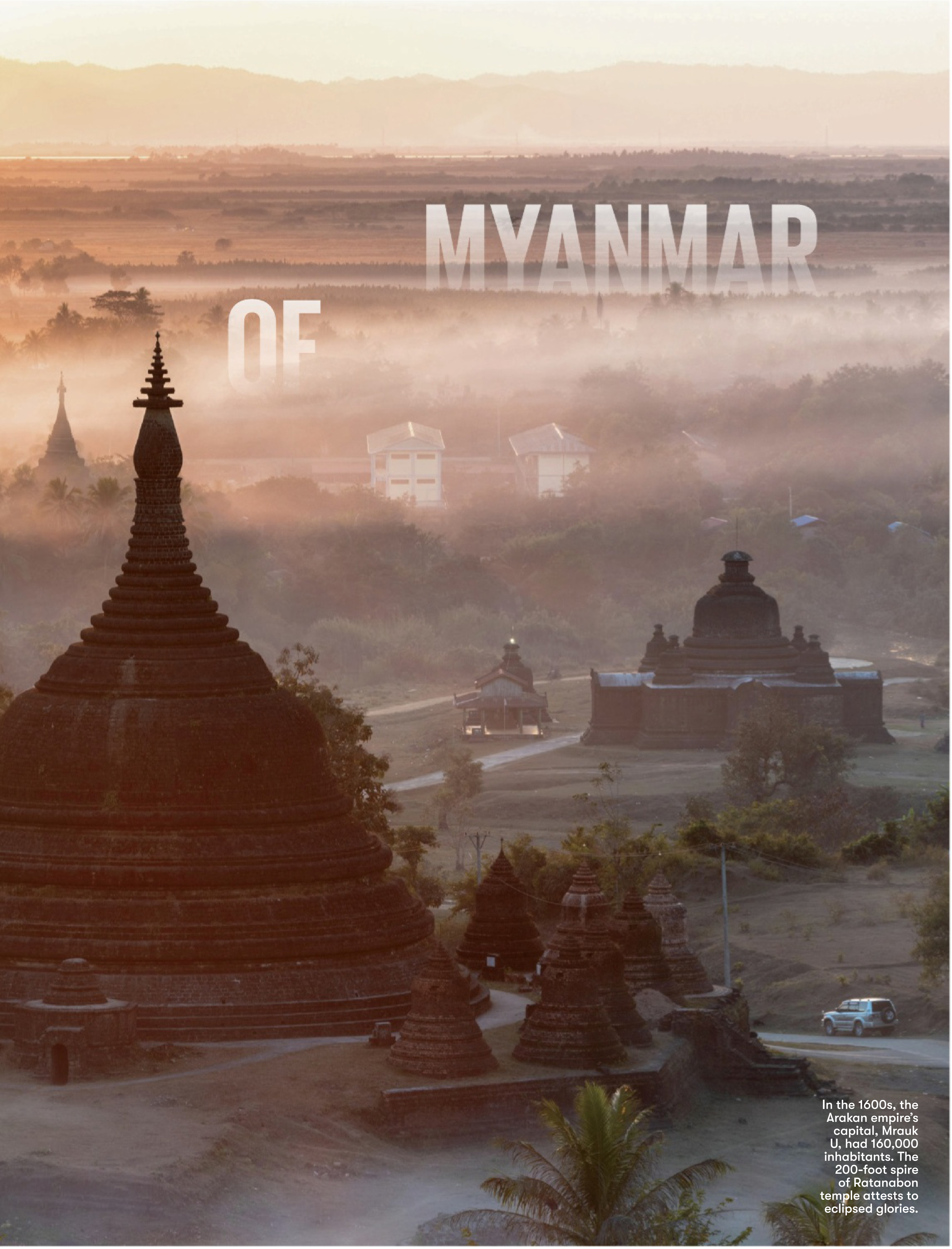


THE LOST CITY

THE ANCIENT KINGDOM OF MRAUK U WELCOMED BUDDHISTS AND MUSLIMS. NOW EFFORTS TO UNCOVER ITS MYSTERIES ARE THREATENED BY ETHNIC HOSTILITIES

by JOSHUA HAMMER

OF MYANMAR



In the 1600s, the Arakan empire's capital, Mrauk U, had 160,000 inhabitants. The 200-foot spire of Ratanabon temple attests to eclipsed glories.

IN SEMI-DARKNESS, I MAKE MY WAY down a tunnel-like corridor, treading barefoot on the cold stone floor. Fifty figurines of the Buddha, five feet tall and remarkably lifelike, flank one side of the vaulted chamber, eyes cast downward in contemplation, each painted face subtly individuated—broad or slender noses, smiles or frowns, chins pointed or rounded. A shaft of natural light at the far end of the passage softly illuminates their serene expressions, broad chests and graceful hands. Across the corridor sit hundreds of Buddha miniatures, each sheathed in gilt, resting on black obsidian bases that teeter on two tiers of sandstone. I turn a corner and enter a second gallery; it's decorated with bas-reliefs of water buffaloes, elephants, horses, jackals and peacocks. A giant sculpted serpent eternally slithers along the base of the wall.

I'm deep inside a magnificent Buddhist temple in the ruined city of Mrauk U in western Myanmar (formerly Burma), in embattled Rakhine State. Beginning around 1535, a thousand workers labored for a year to construct the thick, nearly windowless walls, cutting massive sandstone blocks and fitting them together so skillfully without mortar that they still hold together.

It is said that Man Pa, king of ancient Arakan for nearly 20 years, erected the temple to celebrate a naval victory over a Portuguese armada and a military campaign against cities across the Bay of Bengal. He adorned the roof with 27 bell-like stupas, or domed Buddhist shrines, enclosed the inner sanctuary in a maze of corridors, and crammed the complex with 80,000 representations of the Buddha in various incarnations. These include real and imaginary animals; bodhisattvas, human beings delaying entry to nirvana in order to alleviate the suffering of others; demigods; protective spirits; and scenes from the *Jataka* tales, ancient allegories from the Indian subcontinent, built around the past lives of the Buddha. Lording over the panoply is a colorful painted-stone relief of Man Pa himself, a slender, godlike figure wearing a gilded robe and three-tiered golden crown shaped like a pagoda. He stands balanced atop an elephant, surrounded by adoring

A ten-foot-tall statue of the Buddha looms inside Shitthaung temple, built in the 1500s by King Man Pa to celebrate campaigns in eastern Bengal.

The temple incorporates more than one worldview. The king, reported a 17th-century Portuguese friar who traveled there, "admitted a few [Hindu] gods into his shrine," reflecting "the tolerance and charity of Buddhism." Below right, a sculpture depicting Man Pa.

"EVERYONE WAS WELCOME HERE, BUT OFTEN THE KING CAME TO SEEK MEDITATION ALONE."

PREVIOUS SPREAD: JAKOB FISCHER / ALAMY STOCK PHOTO; THIS SPREAD: HEMIS / ALAMY (2)

^ Jacques P. Leider (in Bangkok) launched modern research at Mrauk U 25 years ago: “You were doing it all starting from scratch.”

members of his court. The variety and richness of the images are astonishing, and attest to both the king’s piety and ego.

With my translator and guide, Zaw Myint, a teacher of English, I go deeper into the temple, called Shitthaung, and enter its heart: the ordination hall, consecrated for ritual ceremonies such as the *upasampada*, the undertaking of an ascetic life in the manner of the Buddha. Carvings of leering trolls loom on the lintel, warding off evil spirits. At the far end of the room, squeezed into an arched niche, is a ten-foot-tall seated Buddha with immense earlobes and a richly folded tunic, all encased in gold leaf. Direct sunlight pierces a narrow aperture, bathing the figure in what seems like a divine aura; a halo painted vibrant blue, green, red and yellow encircles the Buddha’s head.

A corridor leads into the meditation room, each niche in the walls drilled with deep holes to eliminate echoes and avoid disturbing the king’s contemplations. A sculpted footprint of the Buddha, as well as friezes depicting the Hindu elephant-headed god Ganesh and the supreme Hindu deities Rama and Vishnu, amplify the chamber’s sanctity. “Everyone was welcome here, but often the king came to seek meditation alone,” says Zaw Myint.

> In February, as fighting between the Myanmar Army and Arakan separatists intensified, villagers living near Mrauk U prepared to bury the body of a woman who was killed in the crossfire.

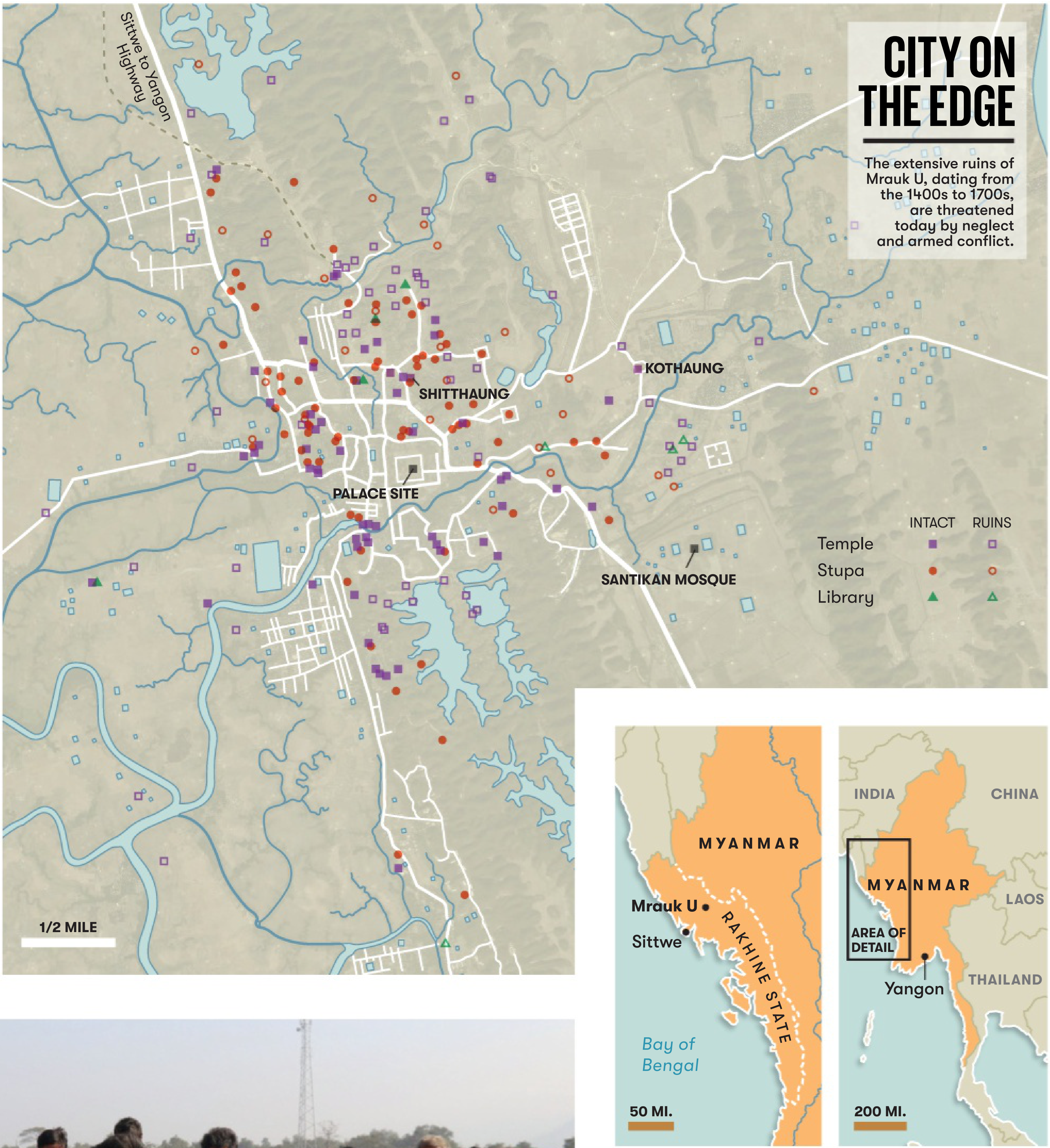
IN A SHRINKING WORLD, the rediscovery of a remote and fabled city is nothing short of miraculous. And few abandoned civilizations have excited the human imagination as much as Mrauk U. It was the power and mystery of this place, tucked away in the Burmese jungle and almost completely forgotten, that lured a French historian, Jacques P. Leider, a quarter-century ago, shortly after the military dictatorship began to open the isolated country to the world. The experience, he says, turned a nagging curiosity into a lifetime obsession.

Now others have begun to share Leider’s fascination. Through early 2019, historians, hydrologists, archaeologists and reconstruction experts, under the auspices of the government of Myanmar with United Nations support, visited this city on a near-monthly basis. Bouncing over dusty roads, crossing rice paddies and climbing up disintegrating hillside trails in the heat, the teams went searching for abandoned glories scattered across the sleepy rural landscape. Some experts believe that Mrauk U is as emblematic of artistic and architectural achievement as Bagan, the ancient Burmese capital on a plain alongside the Irrawaddy River that contains the world’s greatest concentration of Buddhist temples, pagodas and

AMANDA MUSTARD; AFP / GETTY IMAGES; MAPS: GUILBERT GATES

CITY ON THE EDGE

The extensive ruins of Mrauk U, dating from the 1400s to 1700s, are threatened today by neglect and armed conflict.


Sittwe to Yangon Highway
KOTHAUNG
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PALACE SITE
SANTIKAN MOSQUE
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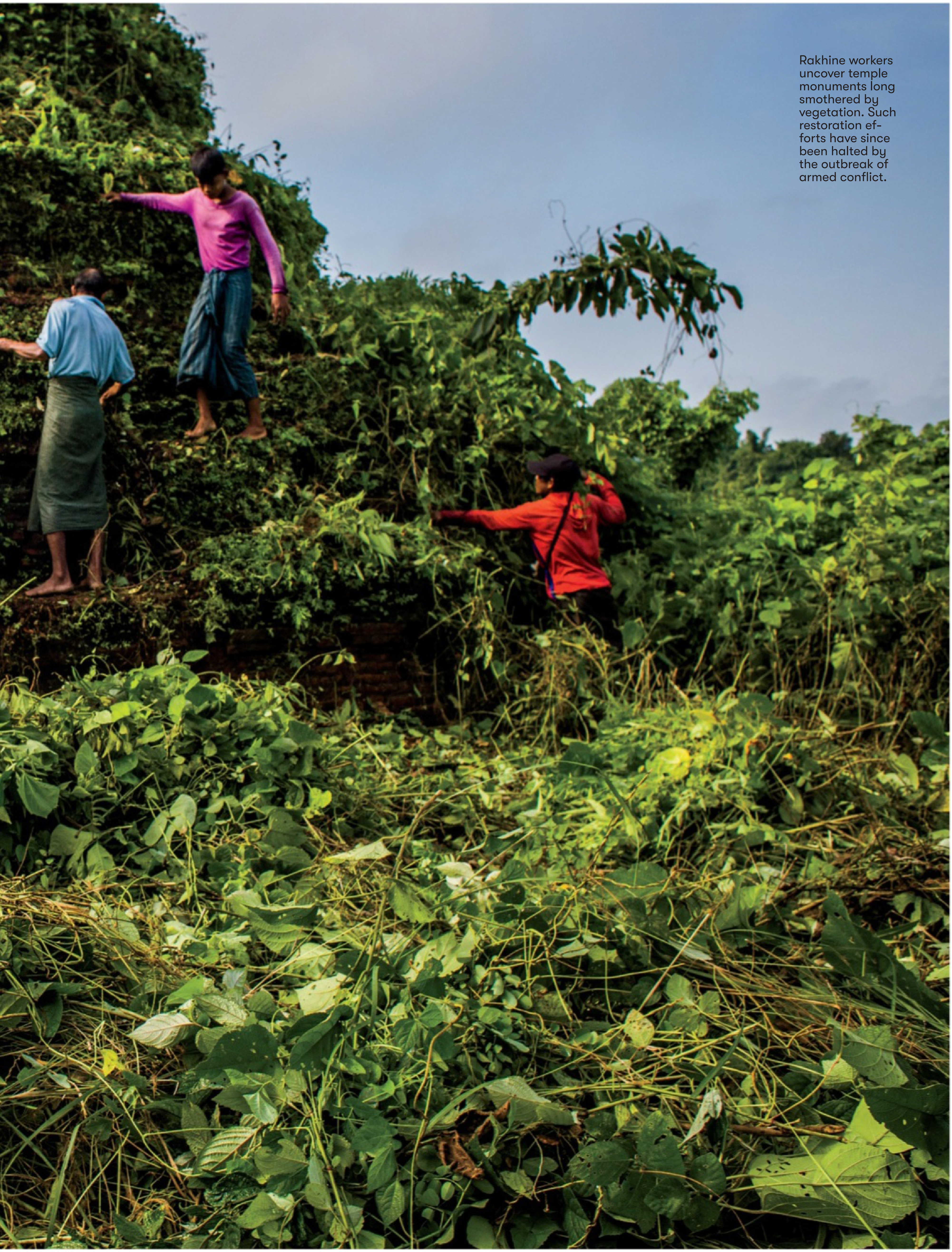
MYANMAR
Mrauk U
Sittwe
RAKHINE STATE
Bay of Bengal
50 MI.
INDIA
CHINA
MYANMAR
LAOS
AREA OF DETAIL
Yangon
THAILAND
200 MI.

SOURCES: BOB HUDSON, MASSIMO SARTI, JACQUES LEIDER, NYEIN LWIN, THEIN TUN AUNG, WIN SEIN, KYAW NYI NYI THET, AUNG MYO THU, YIN MIN TUN, AUNG WIN KYAW. HTUN AYE, SAW AUNG, MAUNG MAUNG NAN NWE, KYAW SOE HTUN, SAN MIN AUNG, THIHA AUNG, THAN MYINT, BA MYAING, MARCH 2019, REASEARCHGATE.NET

stupas. But while Bagan draws more than a quarter-million foreign visitors a year, barely 2,000 foreigners made their way to Mrauk U in 2016—only about six a day.

Two elements make Mrauk U unique: exquisite Buddhist temples constructed largely from stone, and a network of military defenses that utterly transformed the hilly, flood-prone landscape into a fortress city. “There is nothing comparable to it,” says Massimo Sarti, a Unesco consultant hydrologist from Italy, who is helping to support documentation of



Rakhine workers uncover temple monuments long smothered by vegetation. Such restoration efforts have since been halted by the outbreak of armed conflict.

“THE INTERNET DIDN’T EXIST. IT WAS ONE OF THE MOST ISOLATED PLACES IN A SELF-ISOLATING COUNTRY.”

Mrauk U. (Another collaborating entity is China’s Nanjing University.) A 2017 commission chaired by former U.N. Secretary General Kofi Annan recommended expediting Myanmar’s long-standing nomination of Mrauk U as a Unesco World Heritage site, calling it “the greatest physical manifestation of Rakhine’s rich history and culture.”

The life of Mrauk U spanned roughly 350 years, from approximately the 1430s to 1780s, when it was the capital of Arakan, an independent kingdom that at times extended more than 400 miles along coastal plains and mangrove marshlands bordered by the Bay of Bengal. Built on a hilly plateau above two river valleys, and offering easy access to the sea, the walled city was known for its heterogeneity and cross-cultural fertilization. Muslims and Buddhists served side by side in the royal court and the bureaucracy. Dutch, Portuguese, Chinese and other foreign merchants dwelled in their own prosperous quarter, trading spices, textiles, opium, iron, tobacco, sulfur and pepper for rice and ivory. Japanese samurai and soldiers from the Mogul empire guarded the Royal Palace.

The king held court in a hall decorated with carved and gilded teak pillars, receiv-

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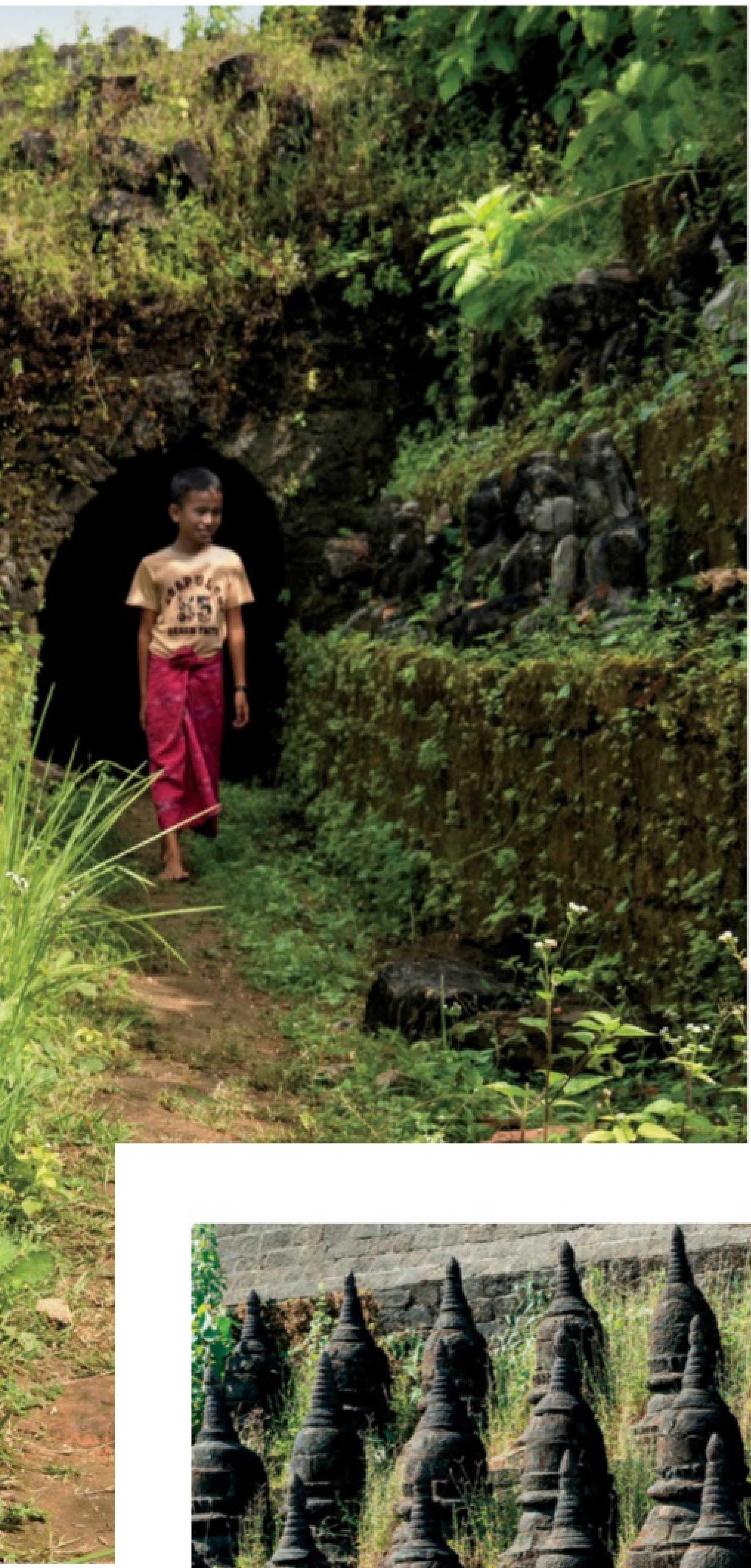


Seated Buddha sculptures flank a passageway inside the ruins of Mrauk U's largest temple, Kothaung, which sprawls a massive 230 by 250 feet.

On the terraces of the Kothaung temple, an elaborate array of miniature stupas, or dome-shaped shrines, replicate the structure's signature architectural feature.

ing a stream of diplomats, courtiers and foreign messengers bearing gifts. "The room of the bejeweled throne is crowded, and Candrasudharma presides in a kingly manner," the Bengali poet Alaol wrote of the monarch at the time of his visit in the 1660s, when Mrauk U was at its zenith. "The noble counsellors wear . . . divine clothes full of fragrances. . . . All the messengers wear many beautiful clothes, musk, aloes and sandal[s]." The Augustinian friar Sebastien Manrique, who lived in the capital during the early 1630s, wrote of vast palace rooms "made of odoriferous woods . . . which thus gratify the sense of smell by their own natural fragrance. There was one room known as 'the House of Gold' for being entirely ornamented from top to bottom in that metal." The city, said Alaol, "is a matchless place on earth."

Those glory days ended in 1784, when Burmese invaders crossed the range of hills dividing their kingdom from Arakan and conquered Mrauk U after several months. The soldiers marched the king and his family, with other members of the elite, into captivity. Mrauk U was left to molder. The British, who seized Arakan in the First Anglo-Burmese War in 1824 and ruled until 1948, had developed an interest in Burmese archaeology during the Victorian era and supported local restoration of the Shitthaung temple in the late 1800s. But World War II and its aftermath derailed those efforts, and successive Burmese military regimes cut off the country from the rest of the

MARIO WEIGT / ANZENBERGER / REDUX; UNIVERSAL IMAGES GROUP NORTH AMERICA LLC / ALAMY

world. Through most of Myanmar's independence, "the city attracted zero interest" from historians or preservationists, says Leider, who heads the École Française d'Extrême-Orient in Yangon.

Now, as the United Nations focuses attention on a city once known for its harmony and religious tolerance, Mrauk U has become a flash point amid the ethnic struggle raging in Rakhine State. A bloody rampage by the army in August 2017 against the stateless Muslim minority known as the Rohingya left thousands dead and drove 700,000 out of the country—most to Bangladesh. (The killings occurred after a Rohingya rebel group had attacked the army.) Long shunned as illegal migrants, the Rohingya now wait in exile, while the international community attempts to negotiate their return to Myanmar. The emerging understanding of Mrauk U, whose history reflects Islam's long presence in the region—a history that some Buddhists continue to deny—has given powerful momentum to the Rohingyas' demand for citizenship and equal rights.

Rakhine's Buddhists also claim ties to the ancient capital. Mrauk U was the center of their unique heritage, violently extinguished by the Burmese conquerors. A separatist group called the Arakan Army has declared war on the Myanmar military. Bloody clashes have erupted near Mrauk U town and the temples, disrupting efforts by international researchers to survey the priceless evidence of the people who flourished here some 500 years ago.

ANY EFFORT TO RAISE the global profile of Mrauk U entails a grueling slog through equatorial heat. One December morning, Zaw Myint and I followed a caravan of four-wheel-drive U.N. vehicles down dusty roads to the northern edge of the city. Elderly men wearing conical straw hats, herding their cattle through pastures, stopped to watch the convoy roll past. We parked the cars by the side of the road. Under a blazing sun, we trailed a Unesco team on foot over narrow dikes crossing dry and fallow paddies, then hiked down a dirt trail past betel nut fields and chili plantations. A drone whined and darted like an outsized insect overhead. Somewhere above us, a single-engine plane was using LIDAR technology to penetrate patches of forest and capture images of structures that have long lain undetected beneath the dense foliage.

After a 45-minute trek, we arrived in front of a 30-foot-tall square brick platform rising over the lush fields. "We think that this dates to the 16th century," said U Than Myint (no relation to my guide), a local historian and director of the Mrauk U Heritage Trust, a private restoration group. He explained that the kings of Mrauk U, constantly worried about attacks from Mogul governors of Bengal across the bay and the Burmese to the east, built ramparts between the hills that ringed the city, along with fortresses and guard posts fortified by cannons. They further protected their city with a network of reservoirs, sluices, spillways, canals and moats—used for irrigation and flood control during peaceful times, and for military defenses in war. In the 16th century, Man Pa opened sluices in the reservoirs and allowed water to gush through spillways, drowning Burmese assailants and turning back an attempted invasion.

Much of those waterworks are gone now, the old ramparts hidden by jungle growth or buried under cultivated fields; the canals silted over long ago. But international efforts have been gradually peeling back the layers, exposing the structures and describing the scale of the city. "There are pagodas and stupas, ancient wells, ceramic kilns, walls and water gates, and canals and lakes. All these belong to the Mrauk U culture," Sarti told me, consulting a topographical map tracing the ancient ramparts and waterworks in different colors. "We're building up a

^ Monks follow a path near Kothaung temple. Canals that once carried people and goods across Mrauk U deteriorated over time.

> Mrauk U residents live amid ancient splendors. Myanmar seeks Unesco designation for the site, unlikely to be granted until the violence ends.

PAUL SPIERENBURG / LAIF / REDUX; PIERS BENATAR / PANOS PICTURES

dossier, with the goal of restoring as much of it as possible. We want to bring it back to life."

Just a stone's throw away from the crumbling garrison, rising over rice paddies stretching into the distance, lies the largest and what many consider the most ambitious temple in Mrauk U: Kothaung. In a gesture of filial one-upmanship, Man Pa's son and successor, Min Dikkha, who ruled the Arakan Kingdom for three years, built the structure over six months in 1553. He topped it with a six-story stupa and filled it with 90,000 sculptures and reliefs of the Buddha—10,000 more images than the temple built by his father contains.

I climbed five receding terraces flanked by hundreds of smaller stupas, entered the shrine, and followed ornate vaulted corridors crisscrossed by shafts of light and spiraling toward an inner chamber. The carved faces of hideous ogres guarded every doorway. The walls at first appeared to be covered with indecipherable inscriptions. Closer inspection of the engravings revealed them to be tiny carvings of the Buddha, some no larger than postage stamps, covering every inch of the sandstone surfaces, the walls broken at regular intervals by pedestals. On each platform sits a Buddha in the classic *Bhumisparsha mudra* position. His right hand reaches over his right knee toward the ground—a gesture said to capture the precise moment of his spiritual awakening and his designation of the earth as witness to his enlightenment.

Though still splendid in places, Kothaung has deteriorated badly over the centuries. Unlike Shitthaung, which was embraced by locals and restored by the Burmese military, Kothaung disintegrated, largely forgotten, in an isolated part of the city. Jungle growth completely covered it until 1996, when the regime began to authorize clearing of the vegetation. Since then little restoration has been accomplished. Much of the roofing has collapsed, exposing row upon row of Buddha figurines to the elements. Buried under heaps of roofing tiles, stones, bricks and other debris, many of the sculptures have toppled off pedestals. Others are missing noses and ears, or have been smashed into stumps. According to legend, the damage was caused by lightning bolts sent down as punishment to Min Dikkha for his attempt to surpass his father's achievement.

JACQUES LEIDER BEGAN studying the history of Arakan as a graduate student in the 1980s, during the darkest years of the Burmese military dictatorship. Not much was known. He was entirely dependent for information on a handful of photographs and articles, plus early 19th-century correspondence inscribed on palm leaves, then copied onto bound paper volumes, gathered by an English wine trader and administrator for the British East India Company in Arakan; those records are now stored at the Bibliothèque Nationale in Paris. "The internet didn't exist, nobody knew how Mrauk U looked," Leider told me over a rice and chicken-curry dinner at the Mrauk U Hotel, a cluster of rustic bungalows on the town's main road, after a long day exploring the ruins in the heat. I had encountered him briefly with other Unesco consultants on top of an ancient stone fortress on the edge of Mrauk U that afternoon, but this was our first opportunity to talk one-on-one. "It was one of the most isolated places in a self-isolating country. I was working blind for seven years."

In early 1994, the cash-strapped military dictatorship, sensing tourism possibilities, cautiously opened the area to foreigners. Exhilarated at the prospect of seeing Mrauk U for himself, Leider boarded a flight in Yangon at the height of the rainy season, flew to Sittwe, the capital of Rakhine State, and took a ferry at dawn up the Kaladan River for six hours—the only way to travel to Mrauk U in those days. The boat chugged through dense morning fog, which

CONTINUED ON PAGE 78

OUR 8TH ANNUAL
CELEBRATION OF
THE **CREATIVE**
BREAKTHROUGHS
SHAPING THE WORLD

2019 SMITHSONIAN AMERICAN *ingenuity* AWARDS

Imaging a black hole required telescopes on four continents. A gene therapy discovery in Tennessee involved physicians from Poland and Germany. That sensational song by Lil Nas X included a beat produced in the Netherlands. Several achievements we salute here, it turns out, have an international dimension. Isn't it curious that our typical American openness to collaboration is often essential to ingenuity?

A year after Lil Nas X released his hit song "Old Town Road," he can't wait for what's next: "I feel incredible. I feel good about the future."

photograph by **KAYLA REEFER**

THE FUNNY THING ABOUT THE LAW

HER SURPRISING DRAMA ABOUT **THE CONSTITUTION** ENCOURAGES A WIDER VIEW OF AMERICAN JUSTICE

by **NEIL GENZLINGER**

SPEND SOME MONEY on your way out of a Broadway theater and you can leave with an overpriced mug or T-shirt. Heidi Schreck sent people home from her show with a souvenir that is arguably much more valuable, and at no charge: a pocket-size copy of the United States Constitution.

Anyone who saw Schreck's play, *What the Constitution Means to Me,* during its five-month Broadway run or on one of its tour stops will surely never think of the country's founding document the same way again.

If the play's title sounds like something from a high school speech contest, there's a reason for that: It was born of Schreck's experiences as a teenager at Wenatchee High School in Washington in the 1980s, when she competed in American Legion oratorical contests. She won enough money doing so to pay for college at the University of Oregon.

In the play, Schreck, who both wrote and starred in it, wryly recreates what she has described as her "teenage girl's bad romance with the Constitution." From that rather adorable premise she embarks on a far-reaching examination of how the Constitution has applied—or not applied—to several generations of women in her family.

She talks about the marginalization of women and other demographic groups, about domestic violence and sexual abuse. She calls out the founders and later interpreters of the Constitution for their male-centric view of the world, in her groundbreaking analysis of what she sees as a living document that can evolve with our times.

Schreck began working on the play in 2007, when she was living in Brooklyn, and performed a brief monologue at P.S. 122, an alternative-theater space in Manhattan's East Village, about her teenage debating experiences. "I really started from the tiny spark that so many plays start from," she told me in an interview this past September, shortly after the play closed on Broadway and was beginning a run at the Kennedy Center in Washington, D.C. "I certainly didn't have a grand idea."

Encouraged by the response to her initial effort, she set about expanding the piece. It was when she posed herself the challenge that her 15-year-old self was given during those contests—find a personal connection between her life and the Constitution—that the work grew into a kind of feminist deconstruction of the nation's founding document. (Schreck's earlier work, *Grand Concourse,* featuring a soup kitchen in the Bronx as its setting, garnered a Lilly Award in 2015 for best new play; she is also a screenwriter whose credits include the television series "Nurse Jackie" and "I Love Dick.")

PERFORMING ARTS

Heidi Schreck

What the Constitution Means to Me

CELESTE SLOMAN

What the Constitution Means "sort of took its own shape," she said. "I felt as if the play led me." Schreck, who was briefly on a prelaw track in college before English and theater swept her away, turned herself into something of a constitutional expert, taking a deep dive into the mind-set of the men who wrote the Constitution, who was left out of it and how it has been shaped over time. In the play, she talks quite a bit about the Ninth Amendment, which says simply, "The enumeration in the Constitution, of certain rights, shall not be construed to deny or disparage others retained by the people." Or, as she puts it onstage, the Constitution doesn't guarantee you the right to brush your teeth, but that doesn't mean you don't have that right. (The Ninth Amendment has helped secure, for instance, the right to use birth control.)

She enlarges, too, on the concept of negative rights versus positive rights—things that the government is expressly forbidden to infringe upon versus things that are proactively guaranteed. She studied up on the constitutions of other nations that have a greater emphasis on positive rights than does the U.S. Constitution. South Africa, for instance, guarantees the right to human dignity, and to a healthy environment.

"These constitutions," she said in an interview, "I find the language around human rights in them inspiring."

Schreck performed the longer version of the play in 2017 at the Clubbed Thumb theater company, also in the East Village. From there it gathered momentum, with runs at Berkeley Repertory Theatre in California and New York Theatre Workshop. Performing in a small venue is one thing; telling a very personal story to almost 600 ticket holders per show, which she did for 169 performances at the Helen Hayes Theater on Broadway, was an adjustment.

"I didn't imagine the level of exposure," she said. Talking about her sex life, her abortion, her family's unsettling history in front of that many strangers was nerve-racking. So was performing the play when one particular person—her mother, Sherry Chastain Schreck—was in the audience for the first time. It was opening night on Broadway. "The first performance was hard—my mother was very emotional, I was very emotional," Schreck recalled. But, she added, Mom went back several times.

The response from the audience also helped her get through the discomfort, as she realized her tale was resonating. "The biggest thing," she said, "which I guess shouldn't have surprised me, is that people like to stay and tell me about their own stories—a lot of people saying, 'This reminds me of my family,' or talking about their own relationship just to being a person in this country."

On Broadway, where foreign tourists make up a significant part of the audience, she was often surprised at the ways in which a play about America's founding document spoke to them. "I've talked to people from Japan, from Germany, Australia, Canada," she said. "They've said, 'It makes me want to look at our constitution.' I had two Japanese women who told me, 'We struggle with all of this in our country.' "

And then there's that freebie Schreck included with the program. "People are so excited about receiving their Constitution," she said.

Schreck may have thought the Broadway run was the pinnacle for the play, but the engagement at the Kennedy Center—with roughly twice as many seats as the Hayes—was a new kind of high. At the end of the play, Schreck brings a high school student (Rosdely Ciprian in the Washington production) onto the stage to debate her as to whether the Constitution should be scrapped entirely. Both of them felt a crackle in the air at the Kennedy Center.

"The debate was more electrifying than it has ever been," Schreck said. "Both she and I realized that we were posing these questions about reimagining what our country might be before people who might actually have decision-making power."

What if Schreck were to convene a real constitutional convention to consider mending some of the document's flaws? What would she focus on?

"I would put the explicit protection of human rights on the agenda," she said. Then she added emphatically, "I would certainly put the Equal Rights Amendment on there." ◆

BYLINES **Neil Genzlinger** has reviewed hundreds of plays, films and television shows for the *New York Times.*

REALITY GETS AN UPGRADE

AN ACE INVENTOR AIMS TO WEAVE **HOLOGRAMS** INTO THE FABRIC OF OUR EVERYDAY LIVES

by **CLIVE THOMPSON**

photographs by **ANNIE MARIE MUSSELMAN**

I'M IN REDMOND, WASHINGTON, in a room at Microsoft, pondering an all-terrain vehicle that has a busted engine. I have no idea how to fix it. I've never done engine repair before.

But I do have some help: On my head, I'm wearing the HoloLens 2, Microsoft's "augmented reality" device. It has a see-through visor, almost like the one on a motorcycle helmet, and the HoloLens projects images onto the visor so they appear to float in the air before you.

When I look at the vehicle, the HoloLens flickers to life, and a guide to fixing the engine pops up in the air. A blue arrow points at a tableful of tools, and when I walk over to it, the arrow indicates that I should grab a torque wrench. Once I take that tool, a new arrow appears, beckoning me across the room to a case of bolts. I grab a bolt, and a third arrow shows me where on the engine to install and tighten it. In under two minutes I've completed the repair.

The sensation is bizarre, like living in a world of Harry Potter magic. I can even touch the holograms. While I'm doing another repair job, a virtual screen with the face of a remote mechanic materializes before me to talk me through the job. The screen is in my way, though—so I grab it by the corner with my fingers, right there in the air, and drag it off to the side.

It's weird. It's fun. And it is, argues Alex Kipman, the Microsoft engineer who invented the device, the future. "I have no doubt that devices like this are going to be the pervasive way of interacting with technology," he tells me. Around

WATCH A VIDEO *of Kipman explaining his inspiration for the Hololens at* ***Smithsonianmag.com/ingenuity***

TECHNOLOGY

Alex Kipman

Designer of HoloLens 2, Microsoft's augmented reality device

Microsoft, Kipman is famous for pushing these sorts of oracular, sci-fi visions. “It's kind of inevitable,” he shrugs. “It's almost obvious.”

I met Kipman in his office, where he was wearing a gray sport coat over a T-shirt with an icon of pixellated sunglasses. He has long hair and a beard and when he talks he fixes you with an intense, Delphic gaze. The glass wall behind his chair was festooned with pink doodles made by his 9-year-old daughter, and the room was cluttered with relics of his work, including a square blue robot, a drone, and a gaming computer with a high-powered graphics card. He beckoned me to sit down at a glass coffee table that was also an art object: Inside was a huge pile of sand, on top of which a magnetic mechanism rolls a ball around, tracing hypnotically pretty patterns.

It's a Kickstarter project he backed. The pattern it's drawing is from software he wrote, he added. “I created a generative AI algorithm that overnight will scour the internet, and, like, dream the internet—and in the morning whatever the AI created, it puts it on the table.”

Kipman grew up in Brazil, got turned onto software by playing with his family's Atari 2600 console, and after studying computer science at Rochester Institute of Technology, joined Microsoft in 2001 as a wunderkind. He toiled for years on Vista, Microsoft's 2007 train wreck of an operating system. Then he shifted into hardware, leading a team to create the Kinect, a newfangled 3-D camera that plugged into Microsoft's Xbox gaming system and tracked players' body movements, allowing them to control a game by moving their limbs. It was a hit, selling 35 millions units, and it fired his enthusiasm for reimagining how we use computers.

He assembled another team to build the first HoloLens, which was released in 2016 to surprised enthusiasm. Surprised because augmented reality (or what Microsoft calls “mixed reality”) had recently seen a hostile reaction to Google Glass, a computer and camera mounted on an eyeglasses frame, which critics derided as too creepy and intrusive for everyday life. (People who wore the device were called “glassholes.”) To keep the HoloLens from falling into the creepiness pit, Kipman pitched it as a tool not for socializing but for working. He imagines an airplane mechanic in Japan using the HoloLens to summon a Rolls Royce engineer to help diagnose a busted engine, or a surgeon having hands-free, holographic access to a patient's X-rays and medical history in the operating room. (Indeed, the recently reborn Google Glass also aims at industrial uses.)

Crafting the HoloLens required feats of miniaturization. One prototype “was like wearing a scuba thing,” laughs Ori Amiga, who develops software for HoloLens. It was shrunken down small enough to wear on your head, but people still complained that it was heavy, and the screen area where holograms appeared was narrow.

For HoloLens 2, Kipman and his team invented tiny mirrors that vibrate 12,000 times per second, generating holograms twice as wide as before. They upgraded to carbon fiber for the device's body, which is half as heavy as aluminum and far more rigid. The carbon fiber also helps stabilize the delicate electronics in the headset, including dozens of sensors that track exactly where your head is turning or where your arms are. “And I'm talking like micron precision, right?” Kipman says. “Nanometer precision.”

Engineering on that vanishingly small scale is what allows Kipman to think big. His ultimate goal: Replace every screen, from smartphone to tablet to monitor, with the HoloLens or one of the next versions of it. “Why would I have my computer if I have infinite monitors in front of me?” he says. “Why would I have a phone?”

Granted, that vision is still years away. HoloLens 2 is a leap in technology from its predecessor, but “we've got a ways to go before we've got something that you can wear all day,” Kipman says. Eventually, he figures it'll be as compact as a normal pair of horn-rimmed glasses. By then, perhaps its sheer ubiquity in the workplace will make it seem acceptable in social life. “You wear them all day,” he says.

When I said goodbye, Kipman argued that if he's really successful, a reporter like me wouldn't need to fly to Seattle to talk to him. We could use HoloLens to speak with the intimacy of being in the same room—a sort of supercharged version of Skyping. But why stop there? Maybe, he mused, artificial intelligence will advance to the point that neither space, nor time, nor anything else on this earthly plane can limit whom we speak to, as AI versions of people are preserved and available at a dial for chatting via hologram.

“Wouldn't it be nice,” he laughed, “if you were in your home, and I had been dead a hundred years, and we were having this conversation?” ◆

BYLINES

Contributor **Clive Thompson's** latest book is *Coders: The Making of a New Tribe and the Remaking of the World.*

Smithsonian previously featured **Annie Marie Musselman's** photo essay on a wolf sanctuary in Washington State.

Kipman seated beside a friendly holographic fox (added by Microsoft) to simulate the view from behind his HoloLens 2 headset.

THE BUCKAROO'S NEW BEAT

A SELF-TAUGHT 20-YEAR-OLD MUSICIAN GALLOPS TO GLOBAL FAME WITH A SONG THAT **DEFIES CATEGORIES**

by **BRITTANY SPANOS**

photograph by **KAYLA REEFER**

NOTHING MAKES A PERSON FEEL more like a lonesome cowboy than being forced to stare down the open highway of the rest of his life. Last year, the then-19-year-old Montero Lamar Hill was doing just that, having dropped out of the University of West Georgia and sleeping on his sister's floor.

Hill, who spent his entire life online and witnessed firsthand the way stars are born through the constantly shifting world of internet content, passed these days making humorous videos on Facebook and going viral on Twitter. But being well liked online doesn't pay your sister's rent. By the end of 2018, she wanted him to move out and take care of himself.

Having grown up in the tiny town of Lithia Springs, Georgia, Hill never envisioned himself as a pop star until he began experimenting with rapping over beats he found online. He released a few songs, to tepid online reception, but now he needed to think big. The next song he would make needed to be his way out.

He spent $30 to download a beat made by YoungKio, a producer in the Netherlands (which prominently samples an instrumental recording by the American rock band Nine Inch Nails), and channeled both his Southern roots and his feelings of solitude.

"I'm gonna take my horse to the old town road / I'm gonna ride 'til I can't no more," he sang, recording on his own in an Atlanta studio on December 2, 2018. Later that day, he released "Old Town Road" under the name Lil Nas X.

Within four months, "Old Town Road" was the No. 1 song on the Billboard Hot 100—and it stayed there for a record-breaking 19 weeks. Almost one year after its release, it has been streamed more than a billion times on Spotify. Lil Nas X signed a contract with Columbia Records, launched his own clothing line with Wrangler (a nod to one of the song's lyrics), adopted some puppies and has been spotted hanging out with celebrities from Rihanna to Oprah.

The story of how "Old Town Road" became the most dominant musical force of 2019 is a mixtape of the flouting of musical boundaries, the explosive potential of digital media, the unfailing capacity of young people to surprise and disrupt, and culture's infinite appetite for the new. It is also the American story of the self-made artist-entrepreneur, updated with instantaneous global fame.

Lil Nas X's campaign began as soon as "Old Town Road" was released; he heavily promoted the track through self-created memes—amusing images and videos that spread quickly and widely online—on Twitter and Instagram, claiming at one point that he made "more than a hundred short videos" meant to amp up interest. He even tried to recruit country star Billy Ray Cyrus for a remix, which came to fruition in March.

"I saw the power to make something bigger from social media because it's done so often nowadays," he explains. "I didn't want to miss my chance. I went for it."

His timing was impeccable: As he was hustling, a new short-form video-sharing app, TikTok, was catching fire. Users could record any kind of video—dancing, lip-synching, model-posing—set to its catalog of songs and reach hundreds of millions of global users immediately. "Old Town Road" became an easy fit for its young Gen Z users, who created cowboy memes set to snippets from the track. It spread faster than even Lil Nas X expected.

It helped that the song was a sugar rush of catchiness that clocked in at just under two minutes. It was both a novelty in the way he emphasized his own Southern accent to flex like a rapping Johnny Cash but also a serious feat in semi-innovation: The steely guitar riff from the Nine Inch Nails song that YoungKio's beat samples made way for the familiar hi-hat snare drums that build the foundation of rap's "trap" sub-genre. "Old Town Road" fused together two adjacent musical worlds, wholly aware of how humorous the concept was.

As the song climbed multiple music rankings, *Billboard* removed "Old Town Road" from its Hot Country chart, claiming that the twangy song about a lone cowboy riding his horse did not "embrace enough elements of today's country music." The decision rankled fans and provoked controversy, especially given that white country artists like Florida Geor-

YOUTH

Lil Nas X

Mixing rap and country on "Old Town Road"

GET AN INSIDE LOOK *at Lil Nas X's creative process at* ***Smithsonianmag.com/ingenuity***

A video of elementary school students singing the breakout hit with Lil Nas X went viral in May. “It was an incredible sight to see.”

gia Line and Luke Bryan have been introducing more rap and hip-hop elements to their “traditional” country sound.

“That is some BS,” the country singer Meghan Linsey tweeted in response to *Billboard*’s move, saying the song’s “got plenty of ‘country elements’ and its [sic] as ‘country’ as anything on country radio, tbh.” Moses Sumney, a singer-songwriter, said, “Lil Nas X’s country chart removal is discriminatory considering how hip-hop production is appropriated in today’s pop-country.”

“Old Town Road” was then a perfect storm: Young kids appreciated its meme fodder while older fans, musicians and critics began taking notice because of the debate about race and genre it ignited. For his part, Lil Nas X was surprised. “I didn’t think any conversation would happen,” he says. “I just thought it would be a nice song that would do good for me.”

Cyrus, who caused his own country music stir in 1992 with his breakthrough pop hit “Achy Breaky Heart,” responded to Lil Nas X’s earlier plea by writing and recording a new verse for “Old Town Road,” which was added to the original. The remixed version catapulted to the top Hot 100 spot, where it stayed for nearly half of this year, while blocking hit-making heavyweights like Taylor Swift and Ed Sheeran from the top.

The next step for Lil Nas X was proving that he was more than a one-time viral sensation. That has worked pretty spectacularly so far. In June, he released *7,* his debut eight-song EP, that featured top names in pop, rap and rock like Travis Barker, Cardi B and Ryan Tedder. He even asked Kurt Cobain’s daughter, Frances Bean Cobain, for permission to interpolate Nirvana’s “In Bloom” on his current Top 10 hit “Panini.” She was a fan of “Old Town Road” and quickly obliged.

Onstage, Lil Nas X is presenting himself as a pop star in the vein of Usher, one of his favorite artists growing up. His performances now feature choreography and backup dancers, which he debuted at the MTV Video Music Awards and in the “Panini” music video. On Twitter and Instagram, he is as fiercely funny as he was when he was best known for making memes; he is still creating viral content to promote his songs and interact with his growing fanbase.

“I wanted to establish, very early on, that I’m not going in whatever direction I’m expected to go into because I don’t want to limit myself on what I’m allowed to do,” Lil Nas X explains.

Audiences are still figuring out how to categorize him. But he’s happily embracing his expansive talent. “I am a rapper in my head. I am a singer in my head. I am a pop star,” he says. “I can try to do as many things as possible.” ◆

BYLINES

Brittany Spanos is a staff writer for *Rolling Stone*. She previously profiled Janelle Monáe for *Smithsonian*.

Kayla Reefer is a photographer and cinematographer based in Los Angeles.

PHYSICAL SCIENCES

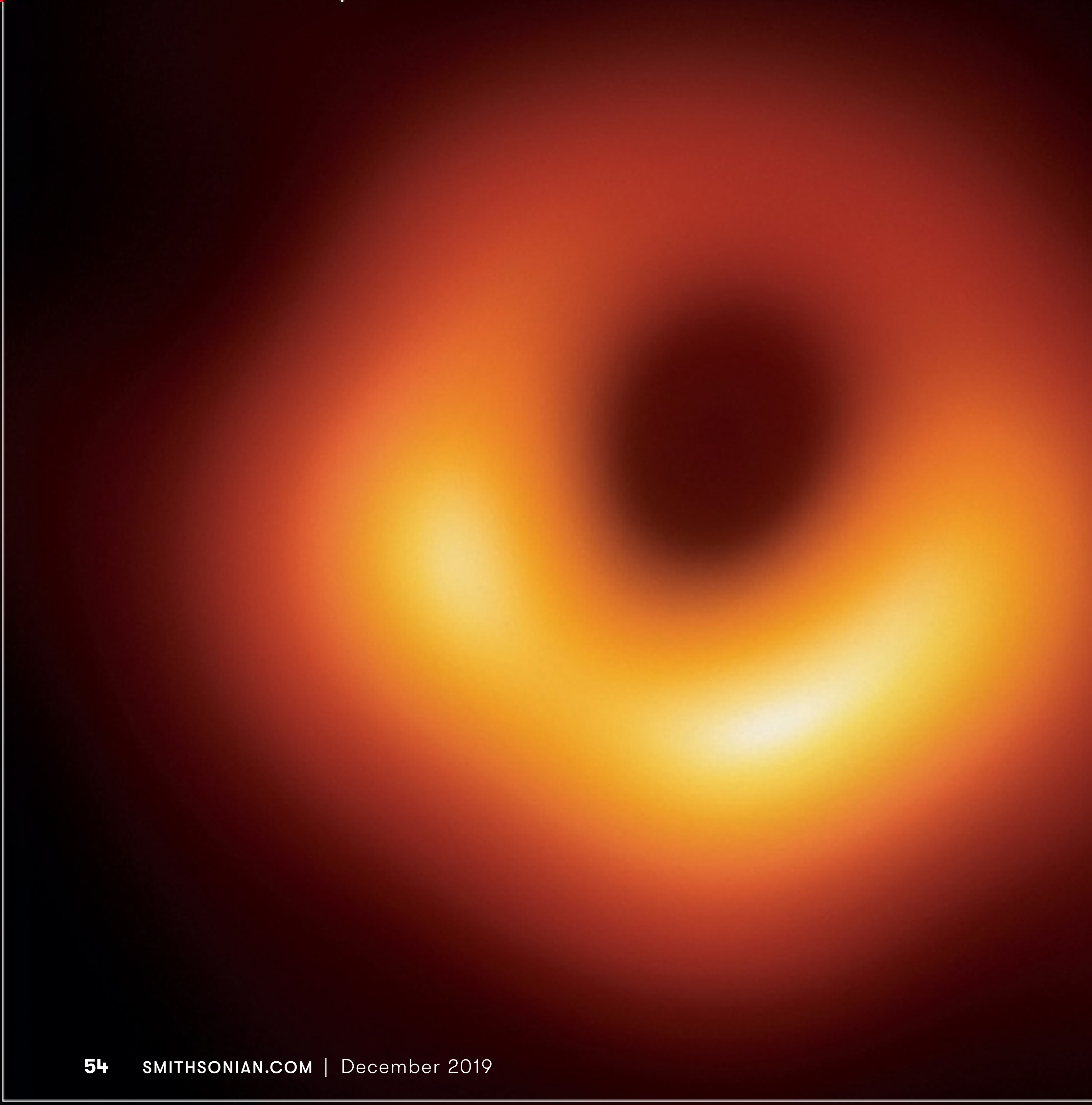
Sheperd Doeleman and the Event Horizon Telescope Team

Captured the first image of a black hole

A GLIMPSE OF IMPOSSIBLE

NEVER BEFORE HAD SCIENTISTS SEEN **THE PHENOMENON** UNTIL THEY RALLIED COLLEAGUES AROUND THE WORLD TO VIEW A GALAXY FAR, FAR AWAY

by **JAY BENNETT**
photographs by **ADAM GLANZMAN**



The Event Horizon Telescope drew on the work of hundreds of scientists at more than 75 institutions all over the world. Some of the project's leaders, left to right, top to bottom, Shep Doeleman, Michael Johnson, Sandra Bustamante, Jonathan Weintroub, James Moran; Feryal Ozel, Joseph Farah, Neil Erickson, Peter Galison, Katie Bouman; Nimesh Patel, Alexander Raymond, Kazinori Akiyama, Vernon Fath, Mark Gurwell.

FROM TIME TO TIME, a new picture of outer space changes our understanding of the universe and our place in it. One hundred years ago, astronomers captured the light of stars behind the sun during a total solar eclipse, proving that the sun had bent the starlight and validating Albert Einstein's new theories of gravity. In 1923, Edwin Hubble captured a pulsing star within the Andromeda Galaxy on a glass photographic plate, revealing for the first time that galaxies exist beyond our own Milky Way. By the 1960s, astronomers in New Jersey had detected radiation from the Big Bang, now called the Cosmic Microwave Background, marking the edge of the observable universe—though they didn't know what they were seeing at first.

This past April, a picture of a black hole, captured by a global network of telescopes, again transformed our perception of the cosmos. That image appeared in major newspapers around the world: a ring of superheated gas 55 million light-years away, about the width of our solar system, spiraling into an abyss with the mass of 6.5 billion suns at the center of the giant galaxy Messier 87 (M87). The picture again validated the physics of

The experiment was so precise that scientists used atomic clocks to sync radio telescopes on four continents. The result: this historic view of superheated gas outlining a black hole.

Einstein, but also provided a glimpse of what may lay beyond the universe we know. Stitched together from several of the most powerful telescopes on the planet, the blurry image of darkness silhouetted by light is the result of decades of work by more than 200 scientists around the globe and coordinated by the Harvard-Smithsonian Center for Astrophysics.

The German physicist Karl Schwarzschild predicted the existence of black holes for the first time in 1915. He used Einstein's equations describing general relativity—published only months before—to suggest that a star above a certain density would collapse into a point of infinite density and infinitesimal volume. That was such a mind-boggling idea that Einstein himself was doubtful. Einstein even tried later in life to prove that the so-called "Schwarzschild singularity" could not exist in nature. But by the end of the 1930s, it didn't seem so implausible. Robert Oppenheimer and his students at the University of California, Berkeley concluded that massive stars could indeed collapse into a point of insurmountable density.

Around these black holes—a term popularized in the 1960s by the American physicist John Wheeler—space-time as we know it breaks down. A black hole devours material from its galaxy, and a border known as the event horizon marks the point of no return. Photons race around this horizon, trapped in an orbit we cannot see because the light never reaches us. Outside the event horizon, swirling dust and gas form a disk of material, heated by friction to billions of degrees.

Though this disk shines brighter than nearly any other object in the universe, it's tricky to capture in an image. Despite their brightness, even the largest black holes are tiny in the sky because they are so far away. From the vantage point of Earth, M87's black hole is smaller than the edge of a dime in Los Angeles as seen from Boston. Capturing something so minuscule requires taking a picture with extremely high resolution.

No single telescope could achieve this—so scientists linked radio observatories in Hawaii, Arizona, Mexico, Chile, Spain and Antarctica. This way, multiple telescopes could always keep M87 in their sights. When the galaxy set over the horizon for one telescope, others in distant parts of the world had already picked it up. Together, the eight telescopes generated data that could later be stitched together by supercomputers.

The technique required precise synchronization, to make all the data points line up perfectly. Atomic clocks—which use hydrogen microwave lasers to keep time—were installed at each location. Such clocks are so accurate that they won't deviate by a second in ten million years.

The first time astronomers tried this technique with high enough sensitivity to measure a black hole, in 2006, the team "failed miserably," according to Shep Doeleman, then an astronomer at MIT and now with the Smithsonian Astrophysical Observatory. "It was a fruitless search," he says. The linked observatories in Hawaii and Arizona didn't detect a thing.

Doeleman and a team of researchers tried again in 2007, linking three observatories to observe Sagittarius A*, a black hole at the center of our own galaxy, which is much smaller than M87 but also much closer. This time, through the obscuring fog of the Milky Way, they saw a tiny blob of radio emissions.

"We knew right away that we had something that was absolutely new," Doeleman says, "that we'd taken the measure of this black hole in the center of the galaxy." But turning the observations into more than just a splotch of radio signals would require more power.

So Doeleman founded a network of observatories, collectively called the Event Horizon Telescope (EHT). In 2011, the Atacama Large Millimeter Array (ALMA) opened in the Atacama Desert of Chile, where the high altitude and lack of humidity create some of the best observing conditions on the planet. This telescope array—the most expensive ground-based observatory in the world—became the EHT's new anchor. By 2016, radio observatories in Spain's Sierra Nevada and atop Mexico's Sierra Negra had joined the EHT as well.

In 2017, everything was ready to go. During five April nights that year, many of the world's most powerful radio telescopes lent their precious observing hours to the EHT. The facilities paused normal operations and delayed other research to allow the global telescope to come alive in search of radio waves from a ring of light encircling the shadow of a black hole more than 300 quintillion miles away.

The weather was perfect, and after shipping over half a ton of hard drives to supercomputing facilities in Germany and Massachusetts, independent teams wrote new algorithms to combine the five petabytes of data—that's five million gigabytes, or enough recorded sound files to play for 5,000 years. The resulting picture clearly showed a ring of material outside the event horizon, glowing brightly around a dark center. The black hole looked just as theoretical models based on Einstein's equations predicted it would.

"First you had to convince yourself that you were looking at real data," says Sera Markoff, an astrophysicist with the University of Amsterdam and a member of the EHT team. "And then there's the 'Oh my God, it really looks the way we thought it would look!'"

"When we saw that ominous shadow wreathed in light, that became real," says Avery Broderick, an astrophysicist at the University of Waterloo. "That really was a black hole out there in the universe."

On April 10, the newly released image provoked awe. France Córdova, director of the National Science Foundation, said the image brought tears to her eyes: "This is a very big deal."

More telescopes are joining the network, including one in Greenland and another in the French Alps. The scientists dream of putting a telescope in orbit and linking it with the ground observatories to see black holes that are currently too small and distant to observe.

Black holes are so massive that they sculpt the matter of the universe, devouring gas, dust and even photons at the center of large galaxies. After theorizing about them for more than a hundred years, we might be in for some surprises now that we can observe them directly. "We've been able to peer down to the edge of space-time, right down to near the horizon," Broderick says. "Where should we find new physics? The answer is, in the places we haven't looked before." ◆

BYLINES

Jay Bennett is an associate digital editor and writer for *Smithsonian* magazine, covering science.

This is the first *Smithsonian* assignment for Boston-based photographer **Adam Glanzman**.

PREVIOUS SPREAD: EVENT HORIZON TELESCOPE COLLABORATION; BRINSON+BANKS (2, BOUMAN, OZEL)

Sherald's newer works are grander in scale, exemplified by the gigantic *If you surrendered to the air, you could ride it.*

THE LUMINOUS TRUTH

THE ARTIST WHO FAMOUSLY PAINTED A FIRST LADY CREATES REVELATORY PORTRAITS OF **ORDINARY PEOPLE**

by **TIFFANY Y. ATES**
photograph by **MIRANDA BARNES**

AMY SHERALD was living in Baltimore and finishing up a graduate degree in fine art when, at age 30, she was diagnosed with a serious heart condition. Nine years later, in 2012, after a harrowing blackout episode, she received a heart transplant, which renewed her commitment to painting as well as her health. In 2016, she submitted one of her paintings, a portrait called *Miss Everything (Unsuppressed Deliverance)*, featuring an elegant African-American woman holding an oversized teacup, to

VISUAL ARTS

Amy Sherald

Reimagining American portraiture

the Smithsonian National Portrait Gallery's Outwin Boochever Portrait Competition. No woman had won the contest in its 12 years. "The night of the award announcement, I thought, I'm not going to get one," Sherald recalls. "Then I heard my name."

She took the grand prize. "Sherald creates innovative, dynamic portraits that, through color and form, confront the psychological effects of stereotypical imagery on African-American subjects," the citation said. The next year, first lady Michelle Obama selected Sherald to paint her official portrait, bringing unimagined public attention. When the painting was unveiled, in 2018, it drove record numbers of visitors to the National Portrait Gallery—so many the work was relocated to a larger room to accommodate the crowds.

This past fall, crowds flocked to view Sherald's first New York solo exhibition, at the Hauser & Wirth gallery. The show, titled "the heart of the matter . . . ," consists of eight new portraits in rainbow hues, starring ordinary people Sherald had encountered by chance in Baltimore and New York and later photographed at her studio. Her subjects' complexions, however, are painted in Sherald's signature grisaille, or gray scale—"an absence of color that directly challenges perceptions of black identity," the gallery says.

Nearly life-size, dressed casually or in work uniforms or in their Sunday best, her subjects invite viewers to linger and reflect. The gigantic 9-foot by 10-foot painting *If you surrendered to the air, you could ride it* (the title comes from Toni Morrison's *Song of Solomon*) shows a young man perched on a green construction beam, gazing toward and above the viewer—an ode to Charles C. Ebbets' iconic photograph *Lunch atop a Skyscraper* that also subtly comments on the overlooked triumphs of black laborers in America. Another painting, *Sometimes the king is a woman*, shows a self-assured woman in a striking, black-and-white zigzag-patterned dress against a bright pink background. Her unassuming yellow earrings seem to whisper a charge to women everywhere—"The time is now," perhaps.

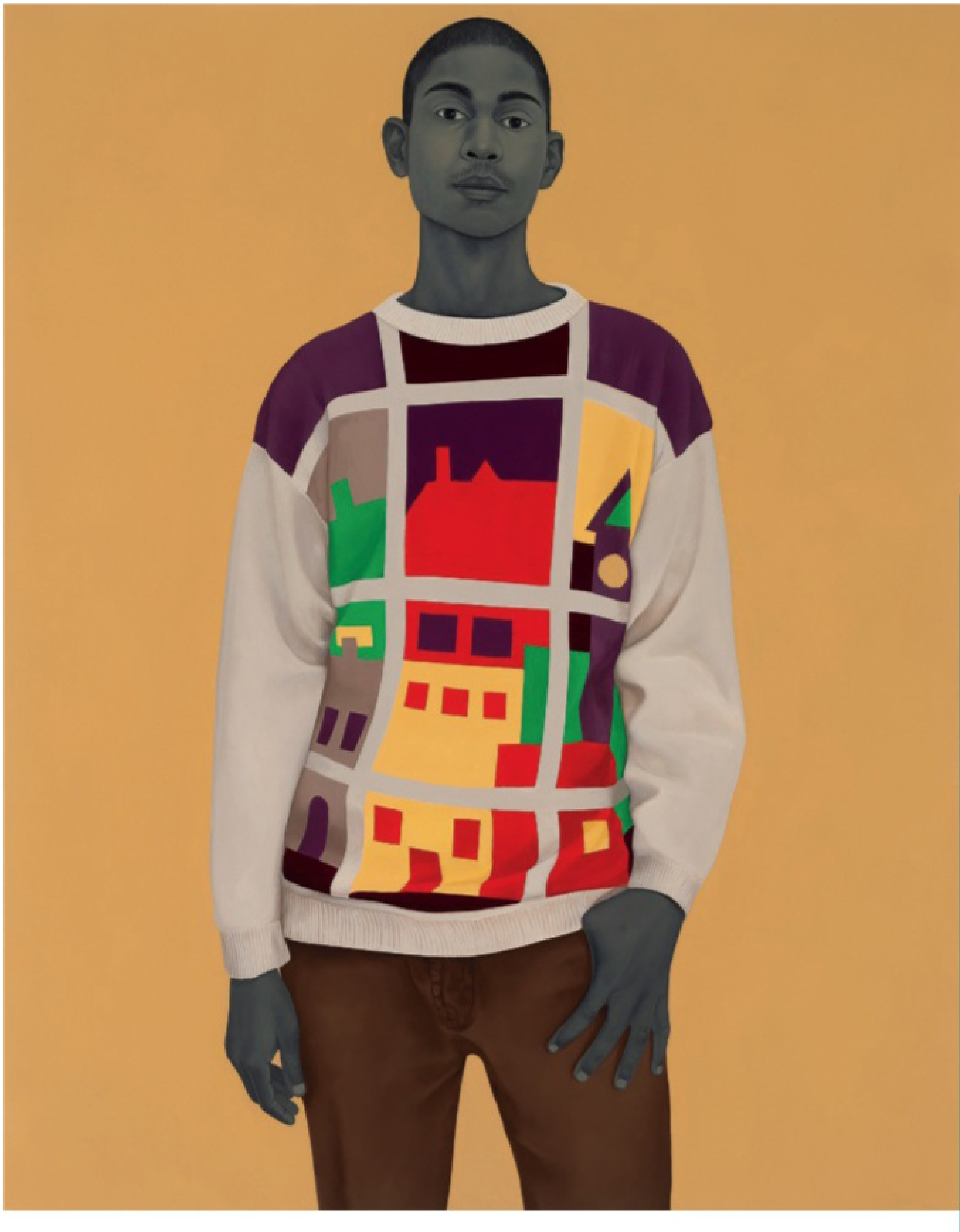
On a brisk October afternoon, a line wraps around the block outside Hauser & Wirth in Manhattan. Inside, stylish patrons chat and snap selfies and stare at Sherald's monumental paintings. In a back office, the artist sits with her dog, August Wilson, named for the playwright, to speak with *Smithsonian*.

What would people be surprised to know about you?

Many might be surprised to find out that if I wasn't an artist, I might be a chef. I was really good at cooking, at a young age.

This interview has been edited and condensed.

As I work, I'll have [the Netflix series] "Chef's Table" playing in the background, because I find inspiration in their practices and what they do. We're both working with these very basic, rudimentary tools. Broccoli is always going to be broccoli, there's no new vegetable that's going to pop up. Similarly, I work with brushes and paint. We take these tools and make something wonderful out of them.



How did winning the National Portrait Gallery's competition affect your career?

The $50 submission fee is the best investment I ever made. I knew at that point in my career, after my heart transplant recovery, I needed something to put me out there. It definitely put me on an international stage and introduced many people to my craft. From there I obtained gallery status, which exposed my work to the art market. The paintings sold, and then suddenly there was a waiting list. I began a crazy work schedule knowing I needed to produce 12 paintings a year.

JOSEPH HYDE (2)

Like many of her works, *A single man in possession of a good fortune* takes its allusive title from literature—in this case, Jane Austen's *Pride and Prejudice*.

Where do you find your inspiration?
Reading—a lot of reading, which is a sacrifice I've had to make at this productive time in my career. I read to start a conversation with myself, to open me up. The bigger your vocabulary, visually and with words, the easier it is to communicate what you're trying to put out there.

What is your favorite part of the artistic process?
I love doing the research, but painting the faces and eyes is the most fun part—I'm able to get to know my models in an intimate way.

You were raised in Columbus, Georgia. How did growing up in the South shape you?
It shaped my identity, my work ethic. It influenced how I saw myself, which wasn't always positive. When I moved back to Columbus for four years to care for family, I thought about who I was in that environment, and how much I "turned on" around certain people. At times, I felt I had to prove to others that black people are better than they thought we were. Acknowledging the performative aspects of race and Southernness, I committed myself to exploring the interiority of black Americans. I wanted to create unseen narratives.

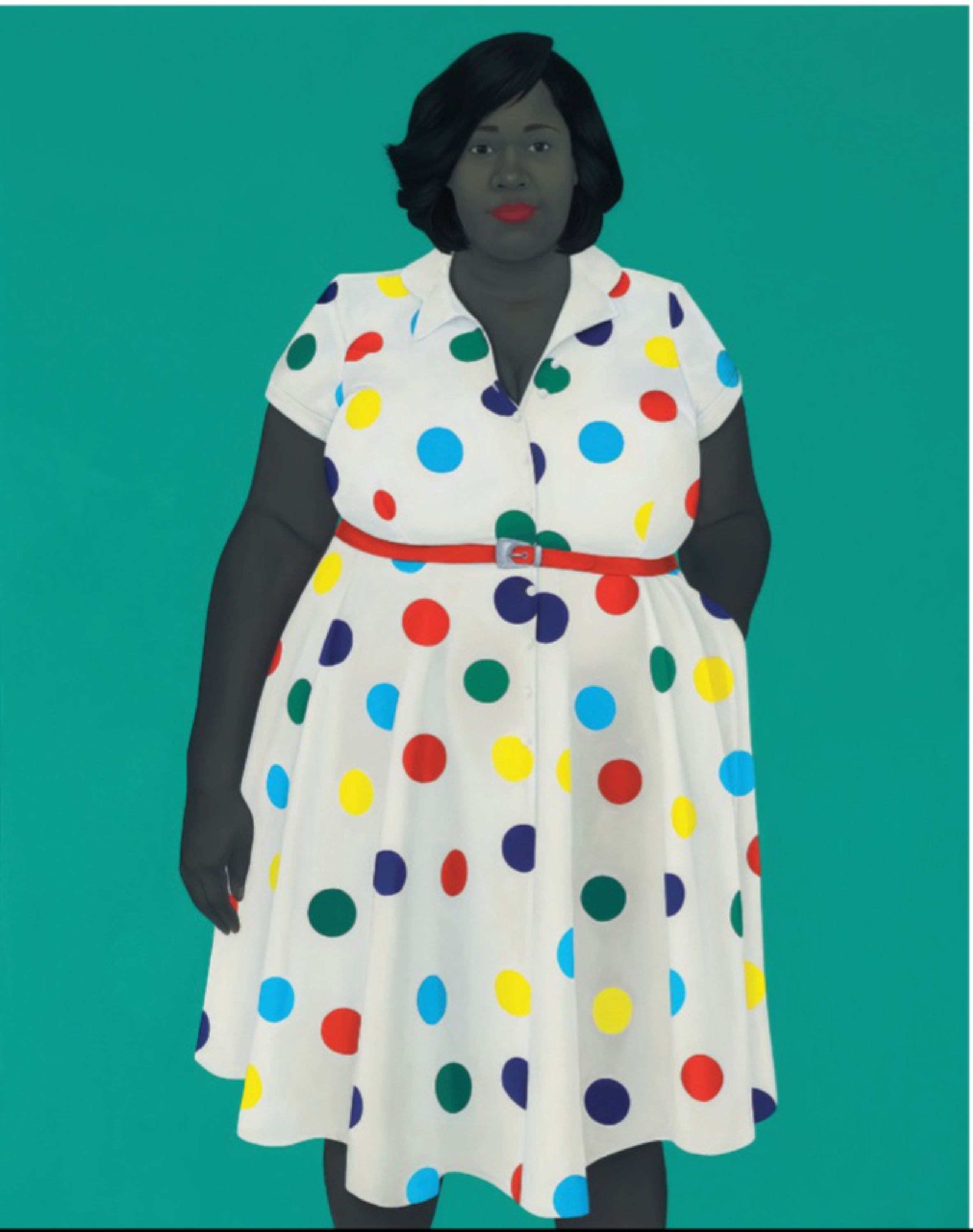
How did you determine what you wanted in your new show?
The show centers around self-love, and blackness—mostly informed by bell hooks' 2001 book *Salvation: Black People and Love*. I borrow its first chapter for the title of the show, and hooks' vocabulary brought me back to a personal love ethic: loving who I was, focusing on who I was on the inside and not thinking about the way that the world sees you.

And Kevin Quashie's 2012 book, *The Sovereignty of Quiet: Beyond Resistance in Black Culture,* informs my interest in interiority. The first chapter examines the image of the 1968 Olympics black power salute as a moment often read as resistance, although John Carlos and Tommie Smith are silent. There's an undercurrent of emotion going on inside of them, which isn't always considered.

So, when I began to think about interiority, I'm like, "That's what it is." My portraits are quiet, but they're not passive. When you consider the African-American historical narrative and its ties to the gaze, a glance could result in punishment by lynching. I wanted my sitters to look out and meet your gaze, instead of being gazed upon. Essentially, that's the beginning of selfhood, a consideration of self which is not reactionary to your environment.

Do you feel pressure to create art with a social justice bent?
A black person on a canvas is automatically read as radical. In hindsight, I look back and I'm like, that's why my figures are gray. I didn't want the conversation to be marginalized, and I had a fear of that, early on. My figures needed to be pushed into the world in a universal way, where they could become a part of the mainstream art historical narrative. I knew I didn't want it to be about identity alone.

What's next for you?
Right now I'm focused on being in the studio. The more museum spaces that I can fill up, the more change these paintings can project. They can be employed in many different ways, but hanging them on walls in accessible public spaces is essential. If you know African-American history, then you recognize the power of their presence. ◆



The girl next door coyly challenges a familiar phrase. Sherald aims to "bring the viewer and the figure to a place of introspection," she says.

BYLINES
Art services coordinator **Tiffany Y. Ates** last wrote about Mickalene Thomas.
Miranda Barnes is a Caribbean-American photographer based in Brooklyn.

FINDING A WAY WITH DNA

MEDICAL RESEARCHERS DEVELOP A **GENE THERAPY** THAT IS SAVING YOUNG PEOPLE AFFLICTED BY A RARE BUT DEADLY DISEASE

by **JESSICA RAVITZ**
photograph by **JOHN DAVID PITTMAN**

ON THE MORNING OF APRIL 25, 2018, in Fort Wayne, Indiana, Omarion Jordan came into the world ten-fingers-and-toes perfect. His mother, Kristin Simpson, brought her dark-haired newborn home to a mostly empty apartment in Kendallville, about 30 miles to the north. She'd just moved in and hadn't had time to decorate. Her son, however, had everything he needed: a nursery full of toys, a crib, a bassinet and a blue octopus blanket.

Still, within his first couple of months, he was plagued by three different infections that required intravenous treatments. Doctors thought he had eczema and cradle cap. They said he was allergic to his mother's milk and told her to stop breastfeeding. Then, not long after he received a round of standard infant vaccinations, his scalp was bleeding and covered with green goop, recalled the first-time mother, who was then in her late teens. She took him to the hospital emergency room, where, again, caregivers seemed puzzled by the baby's bizarre symptoms, which didn't make any sense until physicians, finally, ordered the right blood test.

What they learned was that Omarion was born with a rare genetic disorder called X-linked severe combined immunodeficiency (SCID), better known as the "bubble boy disease." Caused by a mutated gene on the X chromosome, and almost always limited to males, a baby born with X-linked SCID, or SCID-X1, lacks a working immune system (hence the unusual reaction to vaccination). The "bubble boy" name is a reference to David Vetter, a Texas child born with SCID-X1 in 1971, who lived in a plastic bubble and ventured out in a NASA-designed suit. He died at 12, but his highly publicized life inspired a 1976 TV movie starring John Travolta.

Today, technological advances in hospitals provide a kind of bubble, protecting SCID-X1 patients with controlled circulation of filtered air. Such safeguards are necessary because a patient ex-

LIFE SCIENCES

Ewelina Mamcarz and Stephen Gottschalk

Developed a treatment for babies born without an immune system

posed to even the most innocuous germs can acquire infections that turn deadly. As soon as Omarion tested positive for the disorder, an ambulance carried him to Cincinnati Children's Hospital in nearby Ohio and placed him in isolation, where he remained for the next few months. "I had no idea what would happen to him," his mother recalled.

Approximately one in 40,000 to 100,000 infants is born with SCID, according to the Centers for Disease Control and Prevention. Only about 20 to 50 new cases of the SCID-X1 mutation—which accounts for about half of all SCID cases—appear in the United States each year. For years, the best treatments for SCID-X1 have been bone marrow or blood stem cell transplantations from a matched sibling donor. But fewer than 20 percent of patients have had this option. And Omarion, an only child, was not among them.

As it happened, medical scientists at St. Jude Children's Research Hospital in Memphis, Tennessee, were then developing a bold new procedure. The strategy: introduce a normal copy of the faulty gene, designated IL2RG, into a patient's own stem cells, which then go on to produce the immune system components needed to fight infection. Simpson enrolled Omarion in the clinical study and Cincinnati Children's Hospital arranged a private jet to transport her and her son to the research hospital, where they stayed for five months.

St. Jude wasn't the first to try gene therapy for SCID-X1. Nearly 20 years ago, researchers in France reported successfully reconditioning immune systems in SCID-X1 patients using a particular virus to deliver the correct gene to cells. But when a quarter of the patients in that study developed leukemia, because the modified virus also disrupted the functioning of normal genes, the study was halted and scientists interested in gene therapy for the disorder hit the brakes.

At St. Jude, experts led by the late Brian Sorrentino, a hematologist and gene therapy researcher, set out to engineer a virus delivery vehicle that wouldn't have side effects. They started with a modified HIV vector emptied of the virus and its original contents, and filled it with a normal copy of the IL2RG gene. They engineered this vector to include "insulators" to prevent the vector from disturbing other genes once it integrated into the human genome. The goal was to insert the gene into stem cells that had come from the patients' own bone marrow, and those cells would then go on to produce working immune system cells. It was crucial for the viral vector to not deliver the gene to other kinds of cells—and that's what the researchers observed. "After gene therapy, for example, brain cells do not have a correct copy of the gene," explained Stephen Gottschalk, who chairs St. Jude's Department of Bone Marrow Transplantation and Cellular Therapy.

BYLINES

Jessica Ravitz, *a longtime features reporter for CNN Digital, is now a freelance writer living in Atlanta.*

Editorial and commercial photographer **John David Pittman**, an Arkansas native, is a first-time contributor to *Smithsonian*.

In the experimental treatment, infants received their re-engineered stem cells just 12 days after some of their bone marrow was obtained. They went through a two-day, low-dose course of chemotherapy, which made room for the engineered cells to grow. Within four months, some of the babies were able to fight infections on their own. All eight of the initial research subjects left the hospital with a healthy immune system. The remarkably positive results made news headlines after being published this past April in the *New England Journal of Medicine*. “Experimental gene therapy frees ‘bubble boy’ babies from life of isolation,” the journal *Nature* trumpeted.

So far, the children who participated in that study are thriving, and so are several other babies who received the treatment—including Omarion. “As a physician and a mom, I couldn’t ask for anything better,” said Ewelina Mamcarz, lead author of the journal article and first-time mother to a toddler nearly the same age as Omarion. The children in the study are now playing outside and attending day care, “reaching milestones just like my daughter,” Mamcarz says. “They’re no different.” Mamcarz, who is from Poland, came to the United States to train as a pediatric hematologist-oncologist and joined St. Jude six years ago.

Other medical centers are pursuing the treatment. The University of California, San Francisco Benioff Children’s Hospital is currently treating infant patients, and Seattle Children’s Hospital is poised to do the same. Moreover, the National Institutes of Health has seen success in applying the gene therapy to older patients, ages 3 to 37. Those participants had previously received bone marrow transplants from partially matched donors, but they’d been living with complications.

In the highly technical world of medicine today, it takes teamwork to achieve a breakthrough, and as many as 150 people—physicians, nurses, regulators, researchers, transplant coordinators and others—played a role in this one.

Sorrentino died in November 2018, but he’d lived long enough to celebrate the trial results. “In the early ’90s, we thought gene therapy would revolutionize medicine, but it was kind of too early,” said Gottschalk, who began his career in Germany. “Now, nearly 30 years later, we understand the technology better, and it’s really starting to have a great impact. We can now develop very precise medicine, with very limited side effects.” Gottschalk, who arrived at St. Jude a month before Sorrentino’s diagnosis, now oversees the hospital’s SCID-X1 research. “It’s very, very gratifying to be involved,” he said.

For now the SCID-X1 gene therapy remains experimental. But with additional trials and continued monitoring of patients, St. Jude hopes that the therapy will earn Food and Drug Administration approval as a treatment within five years.

Simpson, for her part, is already convinced that the therapy can work wonders: Her son doesn’t live in a bubble or, for that matter, in a hospital. He “can play barefoot in the dirt with other kids, whatever he wants, because his immune system is normal like any other kid,” she said. “I wish there were better words than ‘thank you.’” ◆

WATCH A VIDEO *of Mamcarz and Gottschalk describing their breakthrough at* ***Smithsonianmag.com/ingenuity***

A GENEROUS HELPING OF HUMANITY

BRAVING STORMS, FLOODS AND EARTHQUAKES, THE RENOWNED CHEF IS FORGING A NEW WAY TO **FEED THE NEEDY**

by **JANE BLACK**

photograph by **EMILIANO GRANADO**

W**HEN A 7.1-MAGNITUDE** earthquake rocked Southern California on July 5, it was the most powerful to hit the state in 20 years. Cracks snaked through buildings, roads split, and fires exploded and raged at a mobile home park in Ridgecrest, the epicenter. And yet, within a few hours, a team of chefs from World Central Kitchen was there. WCK, a nonprofit founded by José Andrés, 50, commandeered a middle-school kitchen and, with the help of local chefs and volunteers, began cooking. By lunchtime the next day, there were thousands of sandwiches made by assembly line at a long foldout cafeteria table. By dinner, first responders and scores of displaced residents were being delivered hot plates of smoked paprika roasted chicken over rice studded with stewed tomatoes and bell peppers.

They were still cooking in California when, five days later, with Hurricane Barry bearing down on the Gulf Coast, World Central Kitchen sent chefs to Lafayette, Louisiana, and New Orleans. In about a week, WCK prepared some 35,000 meals.

Over the last two years, in fact, there has not been a day without WCK chefs deployed somewhere—in Mozambique, Guatemala, Colombia, Venezuela, Tijuana and, this past fall, in the Bahamas after Hurricane Dorian, where WCK dished up one million meals.

Media coverage of WCK has focused on Andrés, the outspoken chef from Spain who arrived in the States at 21, after a three-year stint in Catalonia at El Bulli, which was the world’s most acclaimed restaurant before it closed in 2011. By 23, Andrés was chef at Jaleo in Washington, D.C., and now he oversees an empire of some 28 restaurants in 12 cities, including D.C.’s modernist haven Minibar, which holds two Michelin stars.

But World Central Kitchen is not just another celebrity char-

SOCIAL PROGRESS

José Andrés and World Central Kitchen

Aiding disaster victims around the globe

ity project. Andrés' goal is nothing short of a new model for disaster relief that provides better, more nutritious food for less money, all while investing in afflicted communities at the time they need it most. "I get praise more than I deserve," Andrés told me. "Inside me is this feeling that we've not really achieved anything major yet. That even where we are today, it is only a platform for the things that may come ahead."

Andrés has long been a student of the politics of hunger and disaster relief. His lessons began shortly after he arrived in Washington and volunteered at DC Central Kitchen, a nonprofit dedicated to fighting hunger by training unemployed adults to prepare meals for the homeless. Robert Egger, founder of DC Central Kitchen, became a mentor to Andrés, who went on to serve as the organization's board chairman.

In 2010, Andrés was headlining a fancy food festival in the Cayman Islands a few days after an earthquake flattened Haiti. He went there to help, and made a discovery. "We didn't have organizations led by cooks the same way we had rebuilding organizations led by architects or health organizations led by doctors," Andrés said. That year, using $50,000 in prize money from the Vilcek Foundation, which raises awareness of immigrant contributions in America, Andrés founded World Central Kitchen "for cooks like me who want to join forces and feed people in moments of chaos."

It was Andrés' intervention in Puerto Rico after Hurricane Maria in 2017 that made WCK famous. The island was without power and without fuel when Andrés arrived on one of the first flights following the storm; immediately he connected with a network of chefs and purveyors. "These things I had been thinking through and developing in my brain, we knew we could do," he said in an interview. "And we did. We went all in." In his book about the effort, *We Fed an Island*, Andrés is matter-of-fact about how he bullied suppliers to extend him credit for food and used the news media to pressure the Federal Emergency Management Agency for support. He and WCK mobilized chefs, schools, distributors, truck drivers and more than 20,000 volunteers—and served 3.7 million meals over nine months.

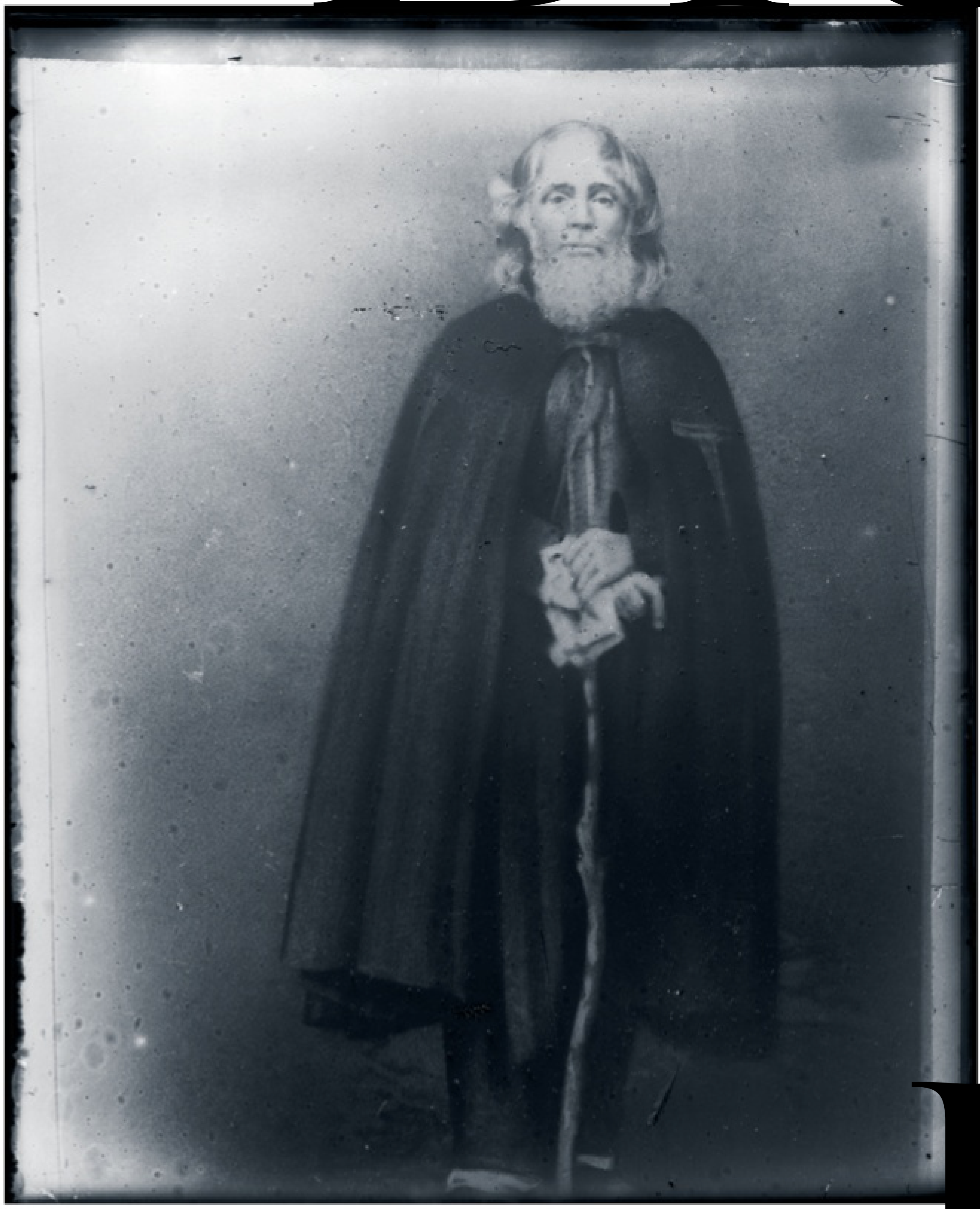
CONTINUED ON PAGE 84

BYLINES

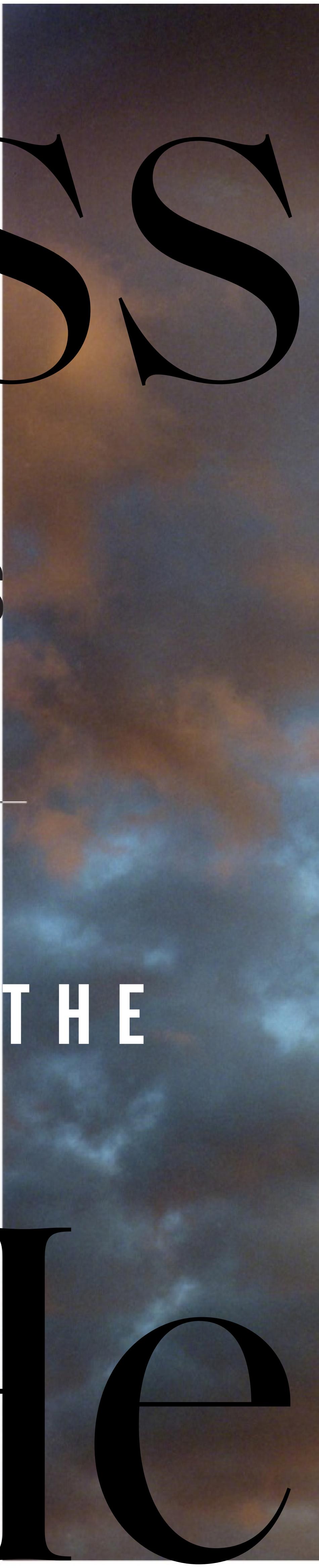
Jane Black writes about food politics for the *Washington Post*, *the New York Times* and *Eating Well*.

Argentina-born, Brooklyn-based **Emiliano Granado** photographed José Andrés in Washington, D.C.

Bless IS THE He



WANDERING VISIONARY
Above, Giovanni Maria de Agostini, a peripatetic Italian monk who was banished from Brazil, reached northern New Mexico on foot in 1863. He holed up on a mountain that would become known as Hermit Peak, today the object of an annual pilgrimage. Right, sunrise from the mountain's base.



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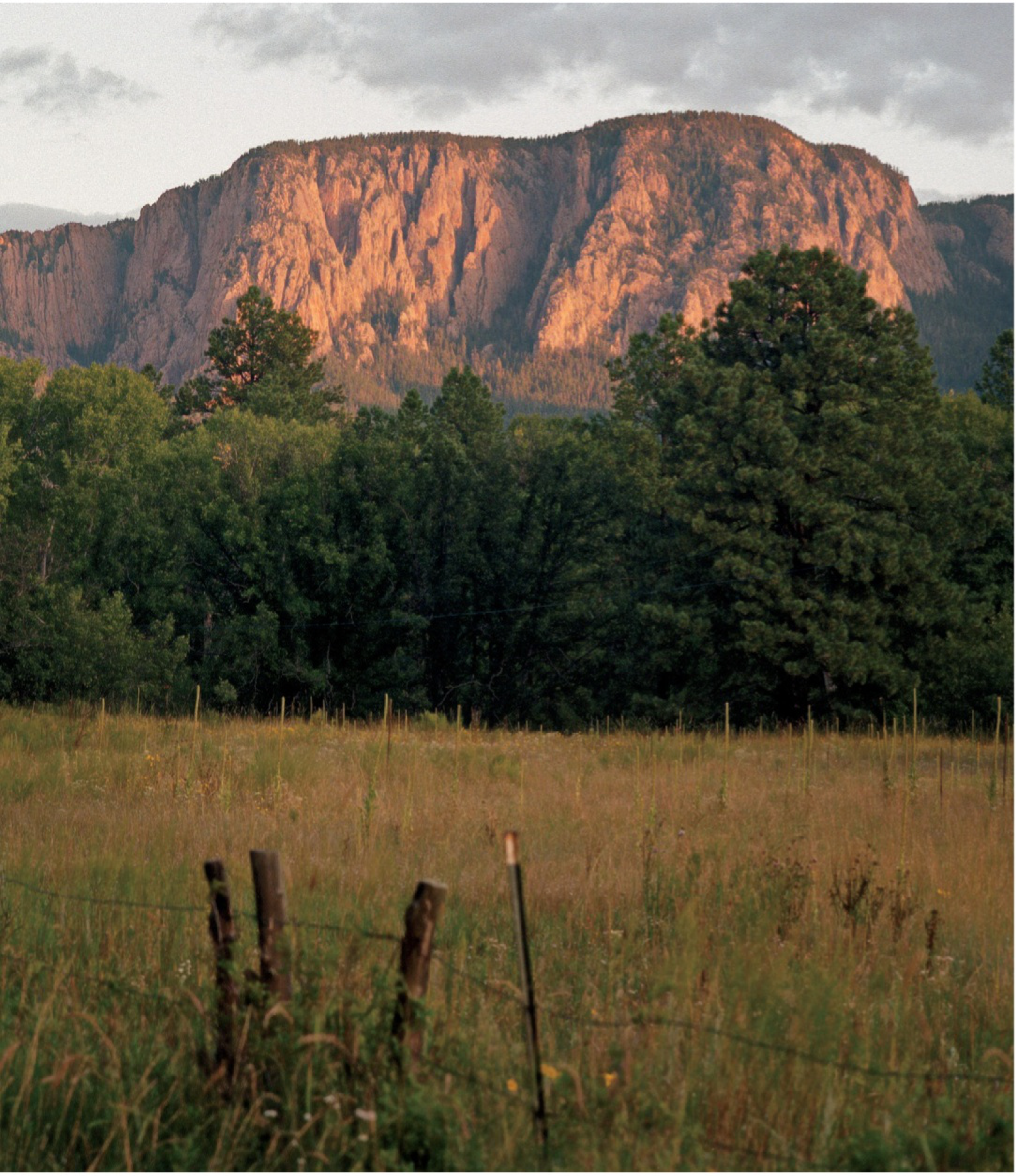
AN ITALIAN MONK WHO LIVED
IN A NEW MEXICO CAVE INSPIRES
A SINGULAR ACT OF FAITH

Photographs by **GABRIEL ELLISON-SCOWCROFT**

Text by **JENNIE ROTHENBERG GRITZ**

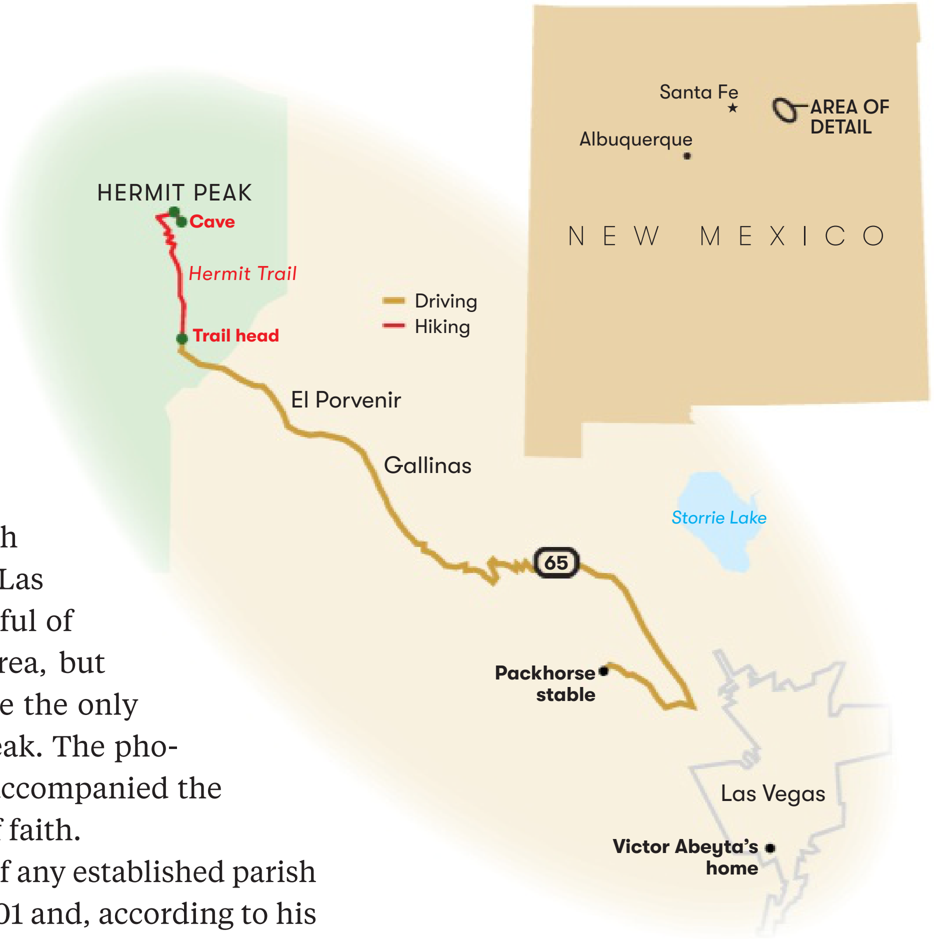
ABOUT 50 MILES EAST OF SANTA FE, NEW MEXICO, in the Sangre de Cristo mountains, **Hermit Peak** rises some 10,000 feet amid the pinyon-juniper woodland of the Pecos Wilderness. The hermit for which it was named was an Italian-born monk, **Giovanni Maria de Agostini**. For three years in the 1860s, Agostini lived high up on the mountain, foraging for food and getting water from a spring. Despite his self-imposed solitude he managed to attract a following during an era of religious fervor and experimentation in America. At the end of the 19th century, a local organization created in his honor, the **Sociedad del Ermitaño**, or the Society of the Hermit, counted 62 members. Their main practice was a long trek to the peak to pray and erect crosses.

PEAK EXPERIENCE
Left, Joseph Abeyta, who took part in the pilgrimage, sports a tattoo of the Virgin of Guadalupe. During Agostini's lifetime, some visitors to his cave on Hermit Peak, below, claimed to see an image of the Virgin in the sky.



P. 64: PALACE OF THE GOVERNORS PHOTO ARCHIVES COLLECTION

FOLLOWING TRADITION
Above, the Abeytas and their packhorse hike up to Hermit Peak, visible in the distance. Along the way pilgrims perform rites, such as the Stations of the Cross, which commemorate the death of Jesus. Right, Victor Abeyta receives a crucifix from his son.

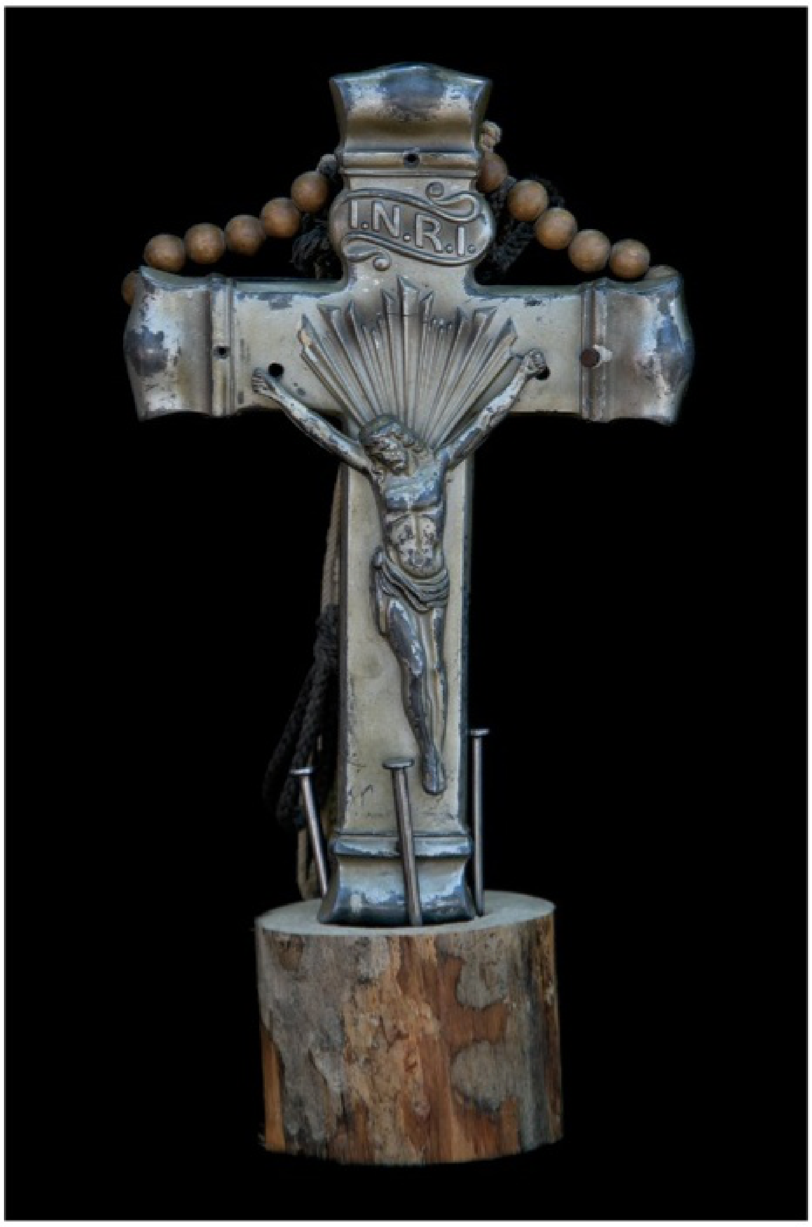

HERMIT PEAK
Cave
Hermit Trail
Trail head
Driving
Hiking
El Porvenir
Gallinas
65
Storrie Lake
Packhorse stable
Las Vegas
Victor Abeyta's home
Santa Fe
Albuquerque
AREA OF DETAIL
NEW MEXICO

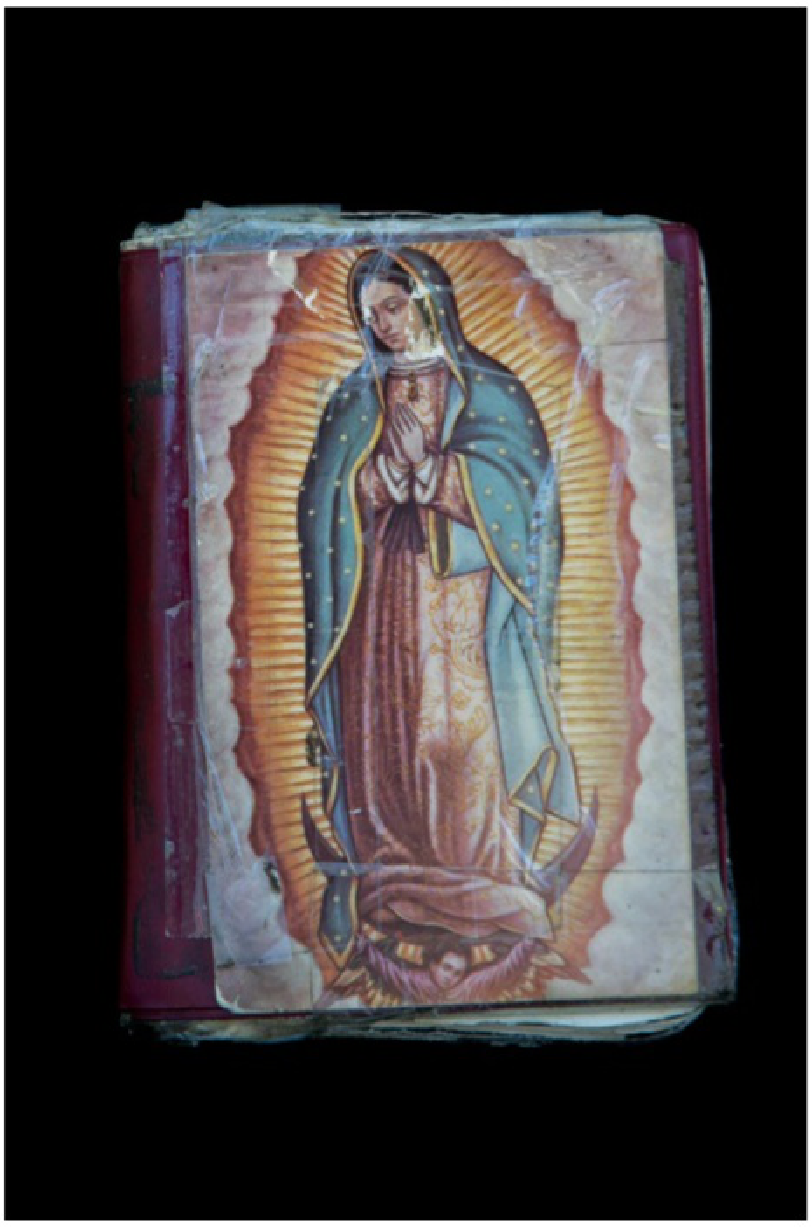
Today, the Society of the Hermit's solemn tradition has faded almost to the vanishing point, and might be lost entirely if not for one family. "I go to Mass on Sundays and I take my kids, but I feel closer to God praying in that cave, remembering that my uncle used to be right here and my grandpa used to be right here," said Joseph Abeyta, a 36-year-old resident of Las Vegas, New Mexico. There are a handful of other Society members still in the area, but this past September, the Abeytas were the only ones who made the trek to Hermit Peak. The photographer Gabriel Ellison-Scowcroft accompanied the family to document this unique rite of faith.

The hermit himself was never part of any established parish or monastery. Agostini was born in 1801 and, according to his writings, "began to incline toward a solitary life" at the age

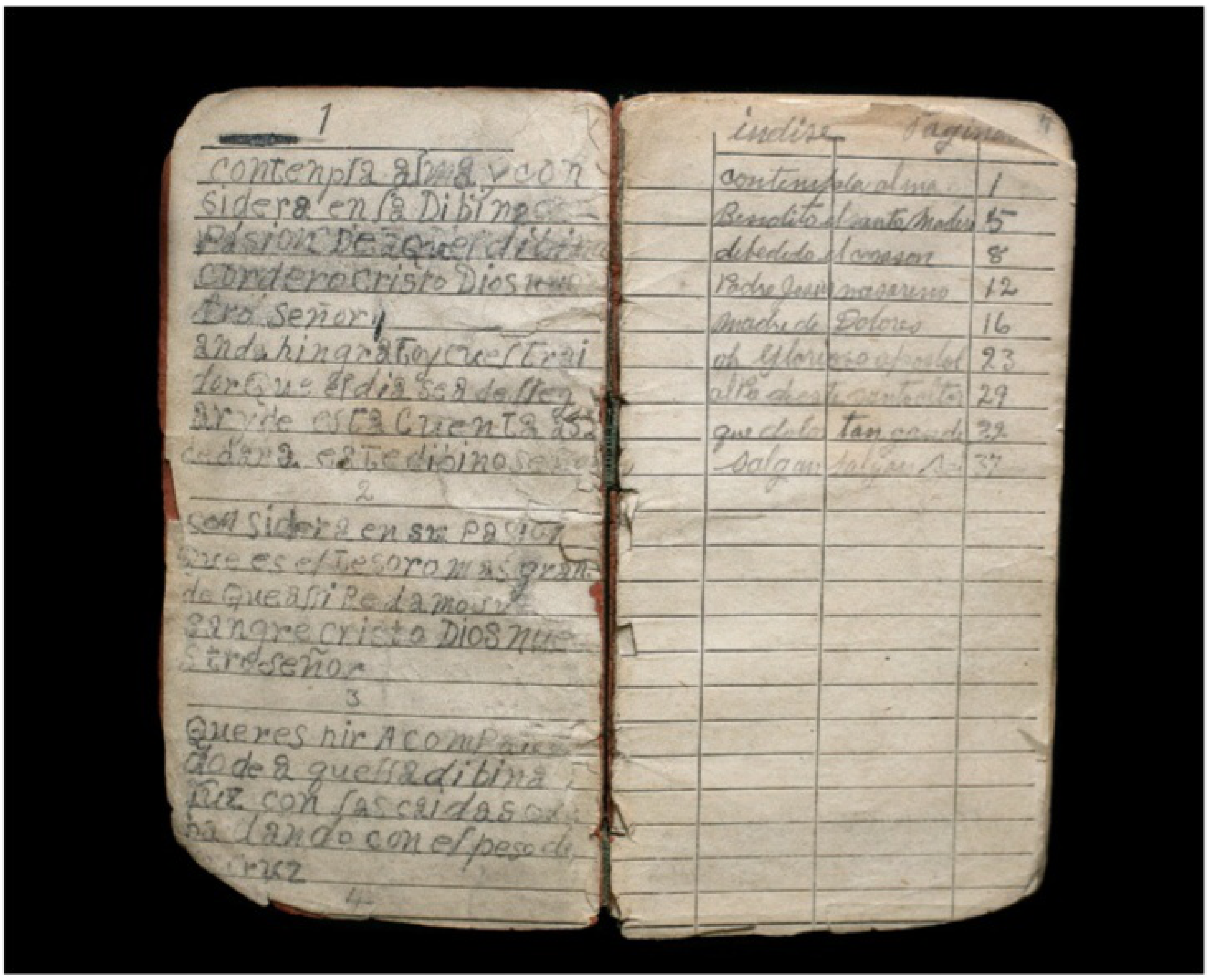
WORD SPREAD WHENEVER THE HOLY MAN APPEARED ON A NEW MOUNTAINTOP.

MAP SOURCE: GABRIEL ELLISON-SCOWCROFT





OBJECTS OF DEVOTION
Clockwise from top left, the Abeyta family crucifix first carried by Victor's grandfather, Felipe Abeyta, born in 1872; a handmade prayer book created by Victor's father, Jose-Felipe Abeyta II, born in 1929; Abeyta family rosaries on a hand-decorated picture frame inherited from Victor's grandmother, Maria Laura Martinez-Abeyta, born in 1890; a book carried by the president of the Sociedad del Ermitaño contains prayers and hymns to be sung during the pilgrimage to Hermit Peak.



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que es el Tesoro mas gran
de Que assi Redamo su
sangre cristo Dios nue
stro señor

3

Queres hir Acompaña
do de aquella dibina
luz con las caidas a
ba lando con el peso de
cruz

4

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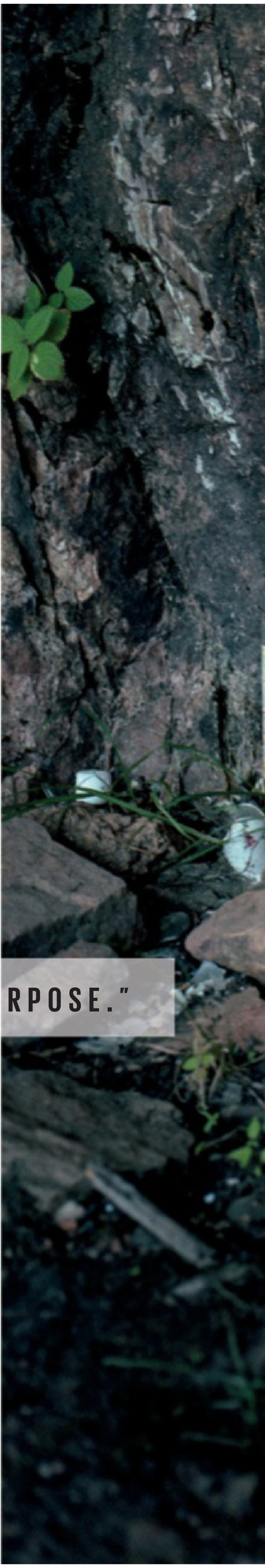
contenpla alma	1
Bendito el santo Madre	5
debedido el corazon	8
Padre Jesus nazareno	12
Madre de Dolores	16
oh glorioso apostol	23
[illegible]	29
que dolor tan grande	32
Salgan salgan [illegible]	37



"THIS GUY WAS VERY INTELLIGENT, VERY WELL EDUCATED. HE HAD A PURPOSE."

of 5. In his 30s, he joined the Maronite Church in Rome. Maronite Christians weren't mainstream in Italy—they're mostly found in Syria and Lebanon—but Agostini wanted to model himself on St. Anthony of Qozhaya, a third-century Maronite who spent 20 years in solitude and then founded the first Christian monastery.

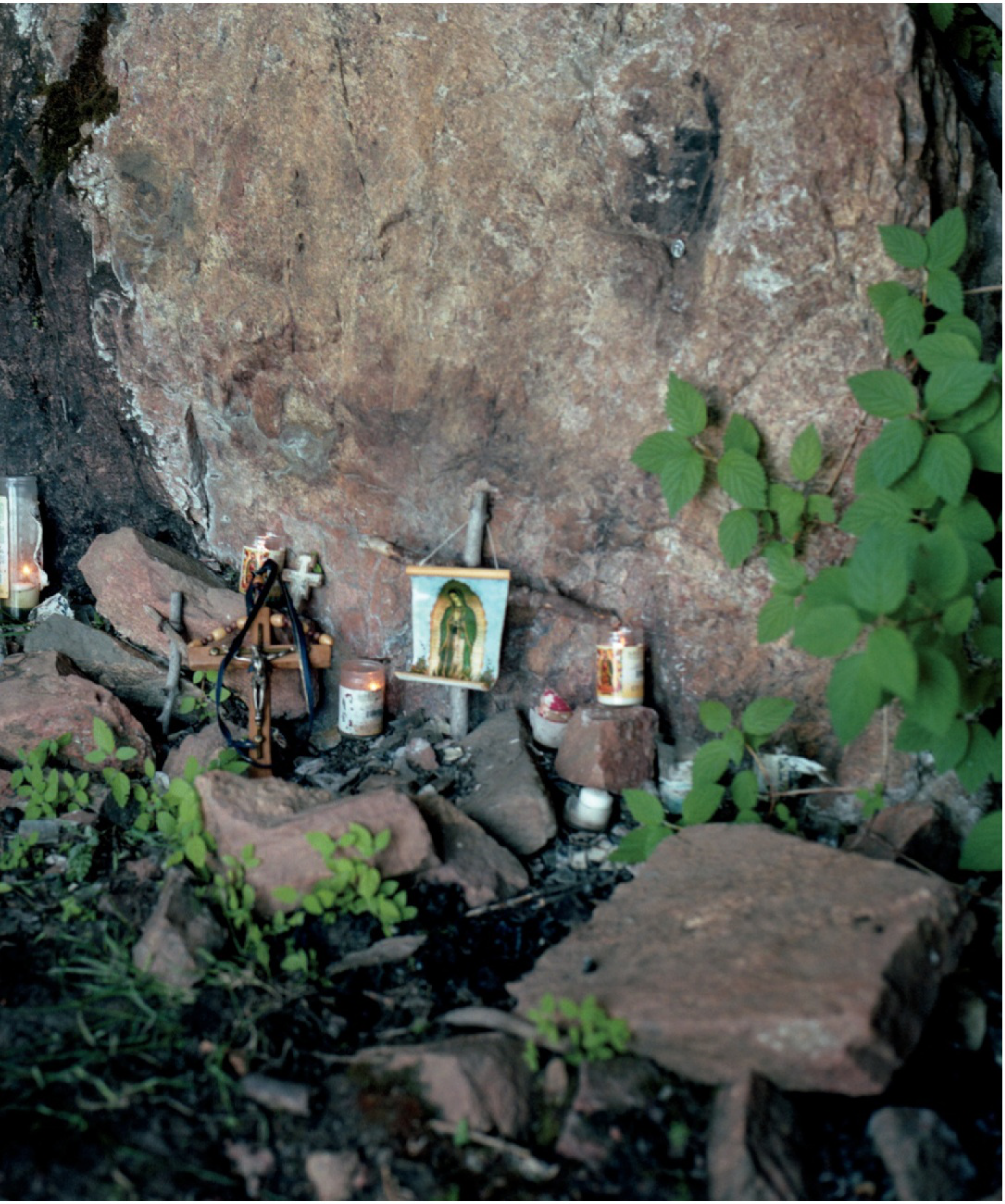
"Agostini did the same thing St. Anthony did," says David Thomas, author of the biography of Agostini *Wonder of the Century: The Astonishing World Traveler Who Was a Hermit*. "He would go to some spot, always picked a cave to live in, and then he would live an exemplary primitive life there." Agostini traveled all over Europe and South America, crossing the Andes twice and canoeing down the continent's major rivers.

Word spread whenever the bearded holy man appeared on a new mountaintop. "Most hermits just want to live out in the middle of nowhere," says Thomas. "This guy was very intelligent, very well educated. He had a purpose." Agostini attracted such a huge following in the Brazilian state of Rio Grande do Sul that the

BYLINES

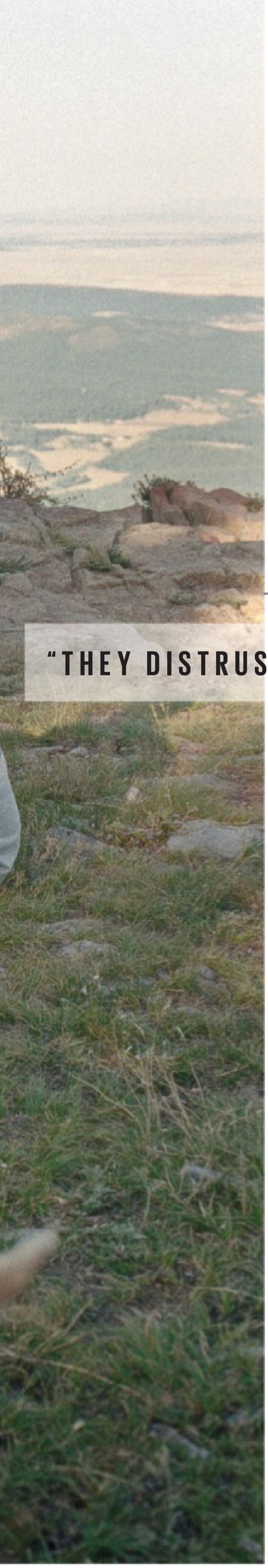
Gabriel Ellison-Scowcroft is a photographer, writer and radio producer from Quebec. He was featured in the *New York Times* in 2018 as one of "12 Emerging Photographers You Should Know."

Jennie Rothenberg Gritz is a *Smithsonian* senior editor.



PAYING TRIBUTE
Left, Tristan Abeyta, 11, lights a candle at the hermit's cave during his fourth annual pilgrimage. Right, the Abeytas' candles glow on behalf of deceased relatives as well as Society of the Hermit members who didn't make the journey.

THE MOUNTAINTOP
Above, the Abeytas prepare to pray the rosary by the three crosses at the top of the mountain. Right, a view of Las Vegas, New Mexico, from the summit of Hermit Peak. Abeyta family ancestors came to the area in the 1600s.



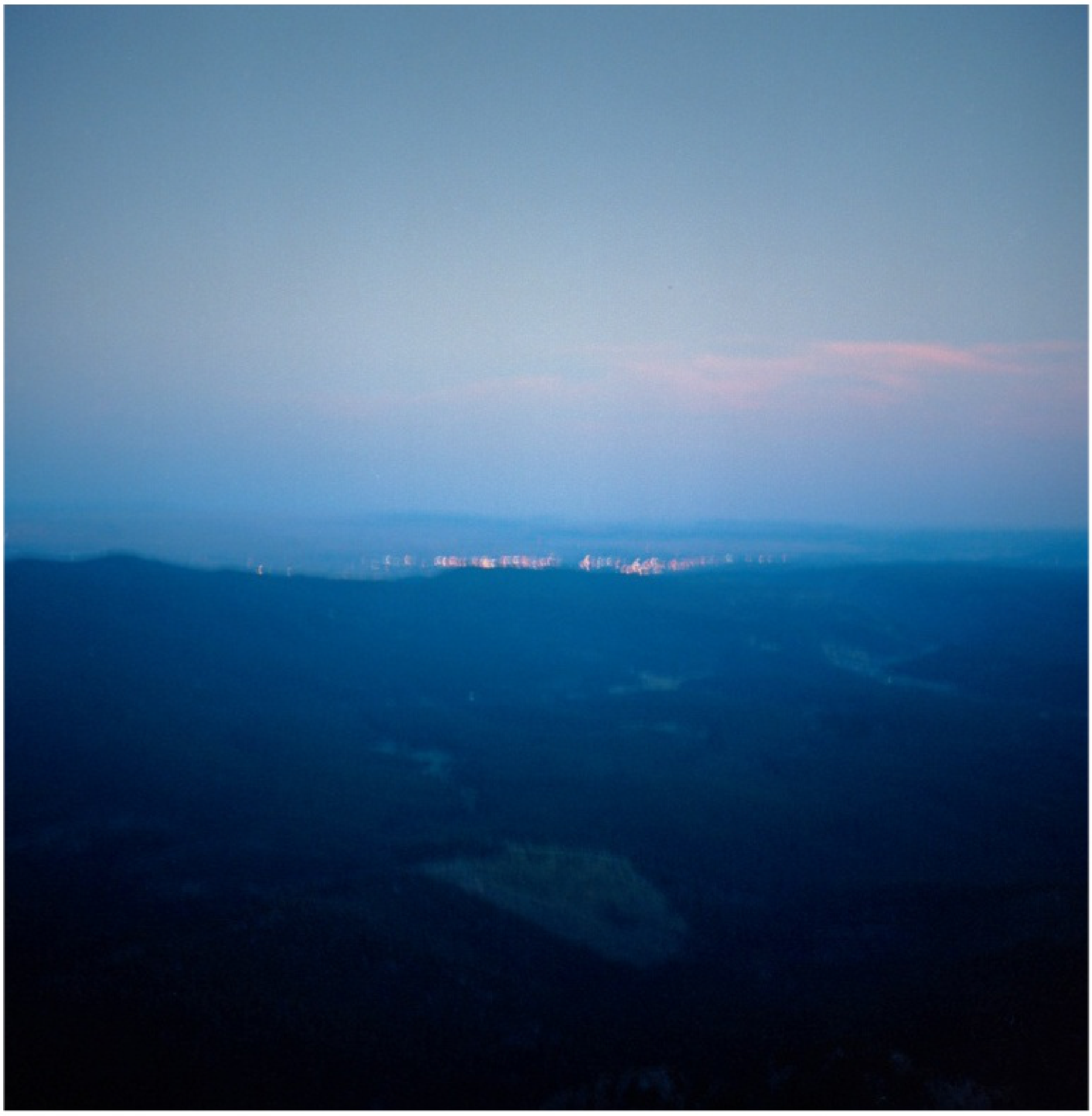
government arrested him. The state's top official wrote in a letter that the monk had "encouraged great fantacism about himself."

In 1861, Agostini headed to Mexico, where he again attracted a large following and was sent to an insane asylum. Officials deported him to Havana after five months, citing the Mexican constitution, which allows the government to expel "any foreigner whose remaining he may deem inexpedient."

From Cuba, Agostini took a steamship to New York and then walked 370 miles to Montreal, where he got a chilly reception. "The cold climate of New France seemed to have congealed the heart of its inhabitants," the hermit wrote in his journal. "My ragged clothes and mean appearance did not appeal to the Canadians." His lack of French also made it hard for him to explain to the Quebecois why he looked and lived the way he did. "They distrusted me and ran away from me. It was the saddest period of my life."

After weighing the idea of going back to Italy, Agostini decided to explore the American West. When he joined a wagon train in Council Grove, Kansas, in August 1863, the *Kansas City Times* reported that the old monk refused to ride in the wagons and wouldn't sleep

"THEY DISTRUSTED ME AND RAN AWAY FROM ME. IT WAS THE SADDEST PERIOD OF MY LIFE."



THE TREK CONTINUES, THOUGH THERE'S ONLY ONE FAMILY LEFT TO CARRY IT OUT.

in a tent. Instead, he walked alongside the wagons and at night wrapped himself up in a coarse blanket to sleep under the stars.

Arriving in New Mexico, a newly annexed U.S. territory, Agostini settled into his cave and practiced his daily devotions. Each Sunday, he walked to Las Vegas, New Mexico, for Mass. The *Las Vegas Daily Optic* reported that "people for miles about were so impressed with the religious character of the newcomer that they commenced making pilgrimages in large numbers to his lonely dwelling." Visitors returned with stories about how the hermit had cured their ailments or made a spring appear by striking the earth with his staff.

The hermit was killed in 1869 in another part of New Mexico by unknown attackers and found with his crucifix in his hand, wearing a cilice—an ascetic's spiked iron belt—that had been around his waist so long his skin had grown over it.

The hermit's austere life and death are much in the thoughts of Joseph's father, Victor Abeyta, as he makes his annual trek. The climb has been harder for him since he was hit by a car in 2004—he now has several metal plates and pins in the lower half of his body. "We're still able to come to this place and use it like they did," he says, surveying the view from the top. "And I'm fortunate enough to still be able to do it." ◆

THE SPRING
Left, in a kind of baptismal renewal, Victor pours water on Joseph as his sons look on. The water is from the hermit's spring, above, which Agostini must have been grateful to discover. Previously he survived on droplets falling into his cave.

Situated on a hill, fortresslike Shitthaung temple was both a monument to the Buddha and an impregnable refuge in wartime.

JULIAN HATTEM / SOPA IMAGES / LIGHTROCKET VIA GETTY IMAGES

Myanmar

CONTINUED FROM PAGE 43

cleared from time to time to reveal ancient pagodas looming above the river. A bicycle rickshaw took him to a dilapidated guesthouse, which had only candles for illumination: The town had two hours of electricity each week and no plumbing. A plastic bottle of drinking water was a rare commodity. "I knew all the names of the temples, but never having been in Mrauk U, I didn't know where they were," he recalls. A one-eyed schoolteacher guided him around the ruins on his bicycle, "telling me stories about temples and kings that I'd never read about."

Leider visited Shitthaung, the temple most revered by local residents, and then entered the adjacent hilltop temple, Htukkanthein, a near-windowless fortress built in 1571 by king Min Phalaung and topped by a mushroom-shaped crown, or *hti*. "It was a mysterious place, linked to black magic," he recalled. Leider groped with a candle along mazelike corridors, at last finding the ordination chamber, where he gazed upon a golden Buddha illuminated by a beam of sunlight. It was a perfect symbol, Leider thought, for man's journey through darkness to enlightenment.

As he made his way out, he encountered a group of young people playing guitars and singing Burmese pop music, which he took as a sign of the cross-generational power of Mrauk U's sacred sites. He left Mrauk U with a feeling of wonder, and the satisfaction of being one of the very first academics to see the place in decades. "You don't run into 75 scholars who have done work on this," he told me.

Leider returned to Europe and, later, took a teaching position at Chulalongkorn University in Bangkok, Thailand. Pursuing his doctorate on the history of Mrauk U, he revisited the city in 1996, 1997 and 1998. Back in European libraries, he combed through the records of a Dutch surgeon, an Augustinian missionary and others who had lived in Mrauk U during its glory days, witnesses to its heterogeneous population.

Arakanese kings are said to have used Muslim-inspired titles such as "shah," and they stamped coins with Arabic and Bengali inscriptions, suggesting a close commercial and cultural relationship with the sultanate across the Bay of Bengal. Moreover, Muslim traders from Bengal, Indonesia and the Moluccas lived inside the city and some established a cult of Sufi saints—traditional protectors of seafarers.

In 1535, the great Arakan king, Man Pa, attacked Chittagong, a prosperous port ruled by Muslim lords for over a century, in what is now Bangladesh. After Man Pa's show of force there, the Muslim presence in Mrauk U grew. Bengali poets patronized the royal court, and musicians and story-tellers acted out

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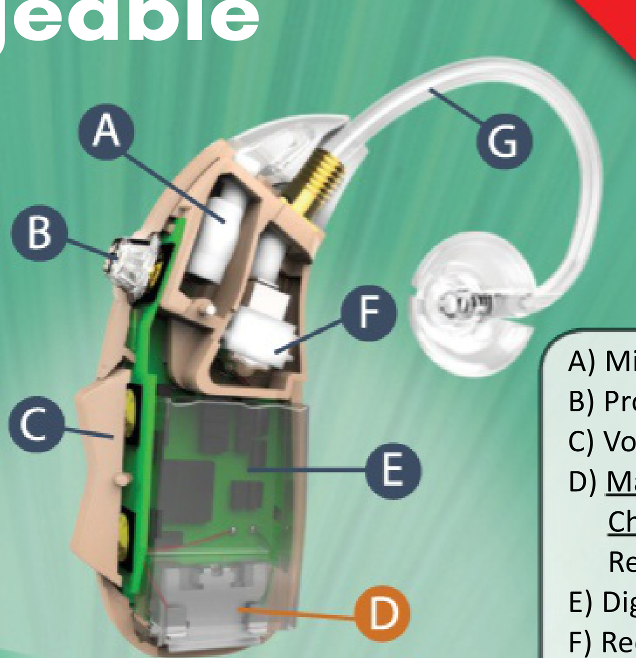

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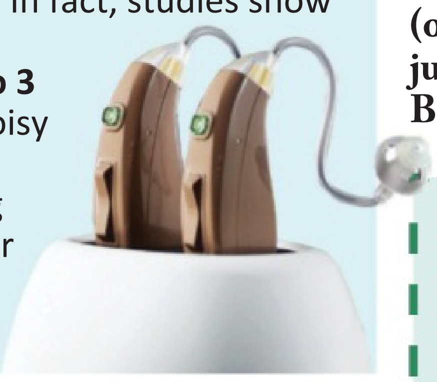

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Visit and Save: **www.AdvancedHearing.com/SM9B** narratives that introduced audiences to the lives of the prophets of Islam. Later, Muslim soldiers were included among the royal guards. The Muslim presence increased further in the mid-17th century, after Shah Shuja (son of the Mogul emperor who built the Taj Mahal, Shah Jahan) was defeated in battle by his brother. Shah Shuja sought asylum in Mrauk U. Hundreds of his soldiers became bodyguards of the Arakan aristocracy.

But by the next century, Muslims in Mrauk U were under pressure. In 1784, the Konbaung dynasty of the kingdom of Burma—a Buddhist realm dominated by the Bamar ethnic group, which today makes up 68 percent of Myanmar's population—conquered Arakan. The Burmese deported leading Buddhist, Muslim and Hindu families from Mrauk U and resettled them near their capital, Amarapura. Only a small Muslim population likely remained.

Today, given the ethnic and religious conflict in the region, any indicator of a significant Muslim community in Mrauk U in ancient times seems portentous. During a trip there in December 2018, Leider and fellow Unesco consultants hiked through the jungle to another important landmark, the 15th-century Santikan mosque, a domed building covered with vegetation. Much of the roof is gone, and weeds colonize what remains of the floor. But the arched entryways and other handsome architectural flourishes suggested it had once been a mosque of some distinction—additional signs that a community of Muslims had lived alongside Buddhists in one of the most powerful cities of its era.

HE, AND MANY OF HIS FRIENDS, NOW SUPPORT THE ARAKAN ARMY, NAMED AFTER THE ANCIENT KINGDOM.

"MRAUK U WAS built by Rakhine [Buddhists] and Muslims together," Abdullah, a Rohingya rebel leader who withholds his full name to protect his identity, told the *Asia Times* in 2017. He called for a return to the ethnic and religious tolerance that had characterized the ancient city. The Rohingyas' demands for full rights, including citizenship, have generated fierce opposition from the government and local Buddhists. The regime classifies Rohingya as "Bengali," even those whose families go back in Rakhine State for generations, and says they are simply fleeing overcrowding in Bangladesh. "There are 160 million people in Bangladesh, and they don't have enough space there; this is one of the reasons that they want their own land in our state," says Tun Ne Win, a secretary general of a local branch of the Arakan National Party, which stands accused of whipping up hatreds against the Rohingya.

The new attention to Mrauk U has unleashed equally strong passions among the Arakan Buddhists, who see Mrauk U as the symbol of a great culture that was snuffed out by the Burmese. In 2014, Rakhine Buddhists received permission for the first time to commemorate publicly the fall of their capital. Thousands gathered at the site of Mrauk U's Royal Palace—now little more than charred foundations—held marches, made speeches, and handed out food to Buddhist monks. But the government was wary of fueling another separatist movement in a country fractured by aggrieved minorities.

Three years later, police opened fire on a group of young protesters, killing seven, all of them in their teens and 20s, and injuring 12. One protester, whose name has been withheld to conceal his identity, was shot in the shoulder and watched one of his former schoolmates die a few feet away. "They showed haste. They could have shot with rubber bullets," he told me. He, and many of his friends, he said, now support the Arakan Army, the Rakhine rebel group formed in 2009. It claims to have recruited 7,000 soldiers—far more than the Rohingya rebels—and has carried out dozens of attacks against Myanmar military and police in recent months.

By the summer of 2019, clashes between the Arakan Army and the Myanmar military, known as the Tatmadaw (armed forces), were breaking out near the temples, wiping out Mrauk U's small tourism industry and forcing international consultants to withdraw. A Burmese source, whose name has also been withheld for protection, describes the situation as it has unfolded: "cut-off internet, troops carrying out tight surveillance in and around temples, abuses to civilians including arrest and torture over suspicion [of association with the Arakan Army]. Tatmadaw soldiers have taken [up positions] in most hills in and around town." In August, following a rebel assault on an infantry base near Mrauk U, the Tatmadaw launched Hellfire missiles from attack helicopters and used artillery to bombard Arakan Army emplacements near Mrauk U town. (Reports indicate that vibrations from shelling may have damaged the temples.)

THE MAJESTY OF MRAUK U remains undeniable. Nearing sunset one day, Zaw Myint and I paid about $1 to an enterprising tea shop owner whose property extends up one of the tallest hills. We ascended a winding wooden staircase behind his hut to an observation point. In the fading light, I gazed west over jungle-covered outcroppings, a complex of square-based temples and a giant stupa in a clearing just below us, scatterings of tin-roofed wooden houses interspersed among the ruins, and, six miles away, silhouetted by the orange sun, pagoda spires rising on a low crest beside the Kaladan River. Wouter Schouten, a Dutch physician, enjoyed a similar view when he arrived here during

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the reign of Sandathudamma, who ruled from 1652 to 1684. “When we ascended sufficiently high up the mountain we could descry the city of Aracan and the golden roofs of the palace, which shone magnificently in the rays of the sun,” he wrote in a memoir of his travels. “Here and there both on the mountain itself and in the valleys the eye fell on many pagodas, which made the view most enchanting . . . indeed, it would be difficult to imagine a more entrancing landscape.”

Daulat Qazi, a Bengali poet who lived here during the reign of Sirisudhammaraja in the 1620s, described a peaceful capital where “no one is envious of each other. . . . Nobody is in distress and all the people are happy through the grace of the king.” One day he accompanied the monarch on a hunting expedition in the forest beyond the city, observing a dazzling display of pageantry that revealed Mrauk U in its splendor: “Elephants of diverse colours were with him. Coloured flags covered the sky. Thousands and thousands of soldiers and horses, without a limit to their number also followed him,” he wrote. “The glory of the king’s boat was beyond measure. . . . Its pillars were of emerald and the roof was of silver.”

“ELEPHANTS OF DIVERSE COLOURS WERE WITH HIM. COLOURED FLAGS COVERED THE SKY.”

Centuries later, Leider, the scholar-adventurer, has been following in the footsteps of these intrepid travelers, seeking traces of the wonders that they discovered. With no sign of peace in sight, however, it’s unclear when he or other scholars and representatives of peaceful international organizations will return. And until they do, their plans and hopes for recapturing a semblance of Mrauk U’s past glory will remain in limbo. ◆

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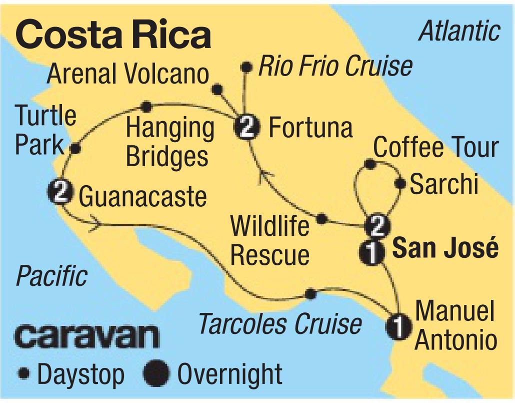

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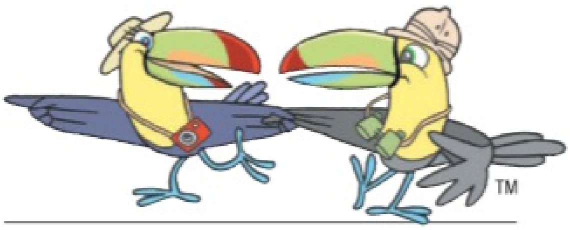

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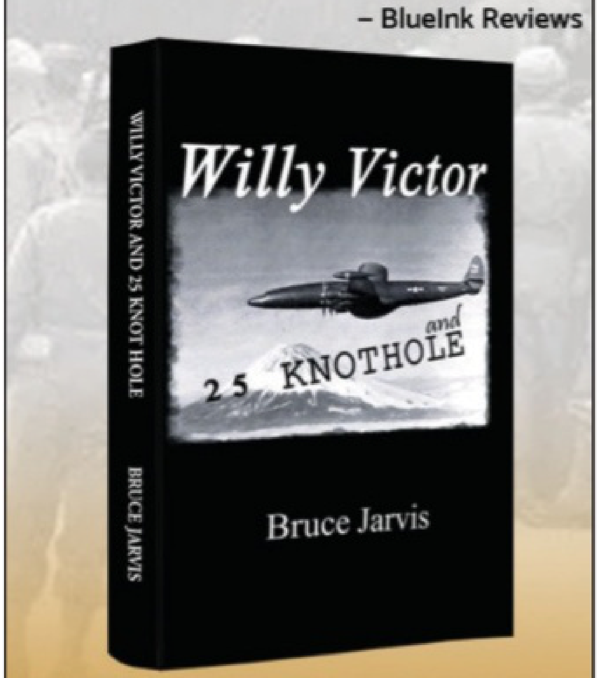

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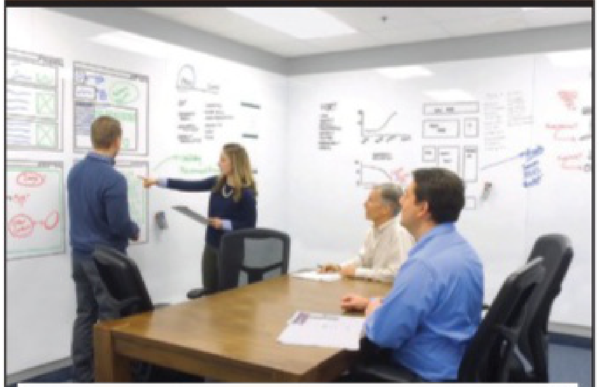

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José Andrés

CONTINUED FROM PAGE 63

Traditionally, feeding disaster victims has been the responsibility of the same relief organizations that provide shelter and medical care, and most of the time the food is an afterthought: meals cooked in expensive mobile kitchens or, worse, MREs, military-style Meals Ready to Eat, such as "rib-shaped barbecue flavored pork" with a shelf life of somewhere close to forever.

Andrés acknowledges that an instant meal that can be stored indefinitely without refrigeration is "an amazing accomplishment by humanity," but says it is meant for soldiers in combat zones, not families displaced from their homes. And so World Central Kitchen strives to source food locally, and wrangles local chefs and volunteers to cook it in nearby commercial kitchens. In other words, WCK staff don't helicopter into a disaster area and pretend to have all the answers; they leverage the community's knowledge and resources, and provide support. Which is often cheaper. On average, a hot meal prepared by World Central Kitchen costs between $2.50 and $4—and much of that money goes to pay farmers, cooks or the guy driving the food truck. The average cost of an MRE is $8 to $10.

"People ask, José, how do you get the food?" says Nate Mook, WCK's executive director. "He always looks at them like they're crazy. 'I'm a chef. That's what I do. I get food.' Our model is entirely different from the way it's always worked. We're software, not hardware."

At a time when chefs are often associated with frivolity or decadence, Andrés uses his renown to open doors and smooth the bumpy path to change. "He is the perfect social enterprise," says Egger. "His success in business as a world-class chef gets him in rooms that, God knows, I could never get into and he uses that to help people."

Not that he enjoys sitting around a conference room table. "There are too many meetings and too many speeches, too much wasteful money thrown at projects when we don't have enough boots on the ground," he said. "Let's get the people in the offices and meeting rooms out and making things happen." ◆

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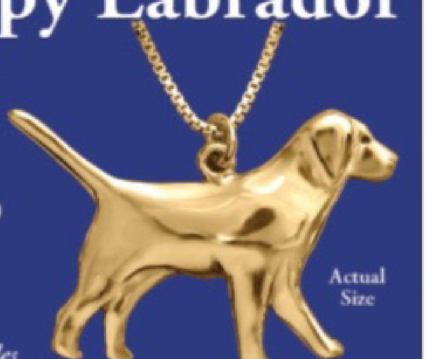

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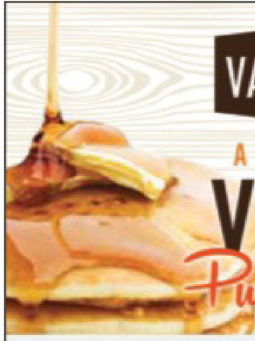

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Scooters

CONTINUED FROM PAGE 22

When people actually own their scooters, they worry about carefully storing and riding them. On-demand users don't, and the firms seem willing to tolerate the resulting equipment damage. As Carlton Reid—author of *Roads Were Not Built for Cars*—points out, the fight for bicyclists' rights was a genuinely grass-roots movement. "The difference now is the companies are doing this—it's Uber, it's these companies that own this, the Limes and the Birds," he notes. On the other hand, having scooters distributed all around town is part of what helps them become widely used, rapidly.

Some argue that cars are the problem: We give them so much space there's little left. Given the emissions of automobiles, and how routinely cars kill people, they shouldn't enjoy such largess, argues Marco Conner, deputy director of Transportation Alternatives, a think tank in New York City. He's in favor of scooters, and thinks cities should build more bike lanes—to give scooters a non-sidewalk place to ride safely—and reallocate one curbside car-parking space per block for micromobility parking and charging. Scooters do reduce car use, he argues: When Portland, Oregon, studied how residents used the scooters, it found 34 percent of the trips replaced a car trip.

"We're accommodating the movement and storage of multiton lethal vehicles," Conner says. With the rise of micromobility, the fight is on again to see what type of wheels will rule the streets. ◆

Answers from Page 13

1 A	2 W	3 W	■	■	4 P	5 L	6 A	7 Y
8 L	O	O	■	9 B	E	I	G	E
10 F	O	R	11 B	I	D	D	E	N
12 A	F	L	A	C	■	■	■	■
■	■	13 D	R	Y	14 U	15 P	■	■
■	■	■	■	16 C	L	E	17 A	18 N
19 R	20 E	21 B	22 E	L	A	R	M	Y
23 A	W	A	K	E	■	24 R	A	P
25 G	E	N	E	■	■	26 O	L	D

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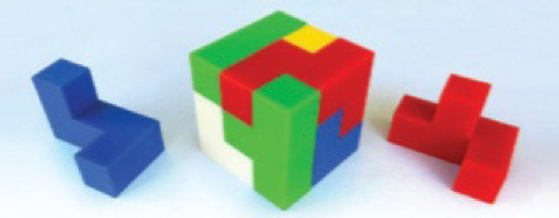

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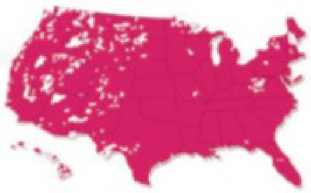

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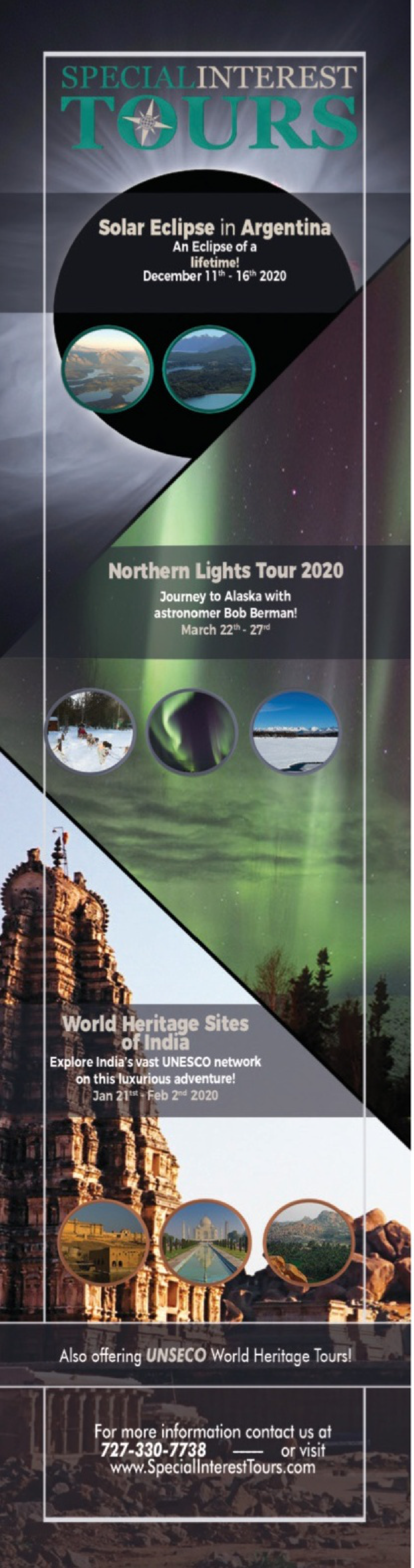
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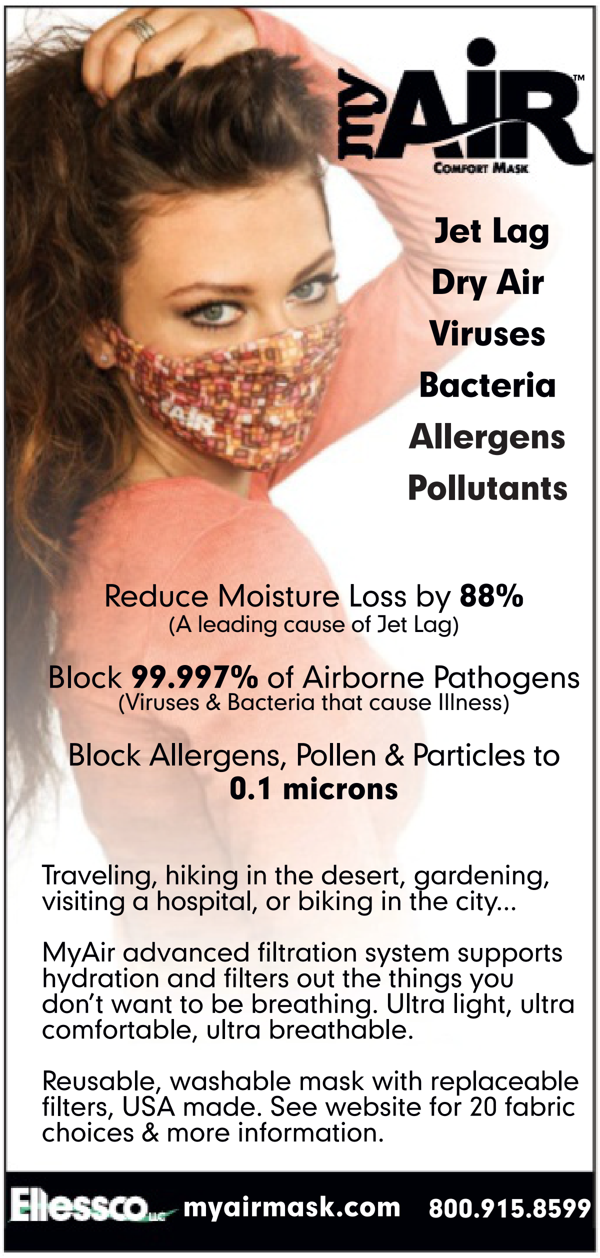
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SMITHSONIAN; December 2019; Volume 50, Number 8. *Smithsonian* (ISSN 0037-7333) is published monthly (except for a January/February issue and a July/August issue) by Smithsonian Enterprises, 600 Maryland Ave. S.W., Suite 6001, Washington, D.C. 20024. Periodical postage paid at Washington, D.C. and additional mailing offices. POSTMASTER: send address changes to Smithsonian Customer Service, P.O. Box 420300, Palm Coast, FL 32142-0300. Printed in the USA. Canadian Publication Agreement No. 40043911. Canadian return address: Asendia USA, PO Box 1051, Fort Erie, ON L2A 6C7.

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Memberships: All subscribers to Smithsonian are members of the Smithsonian Institution. Ninety-nine percent of dues is designated for magazine subscriptions.

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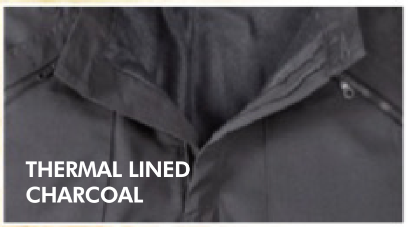

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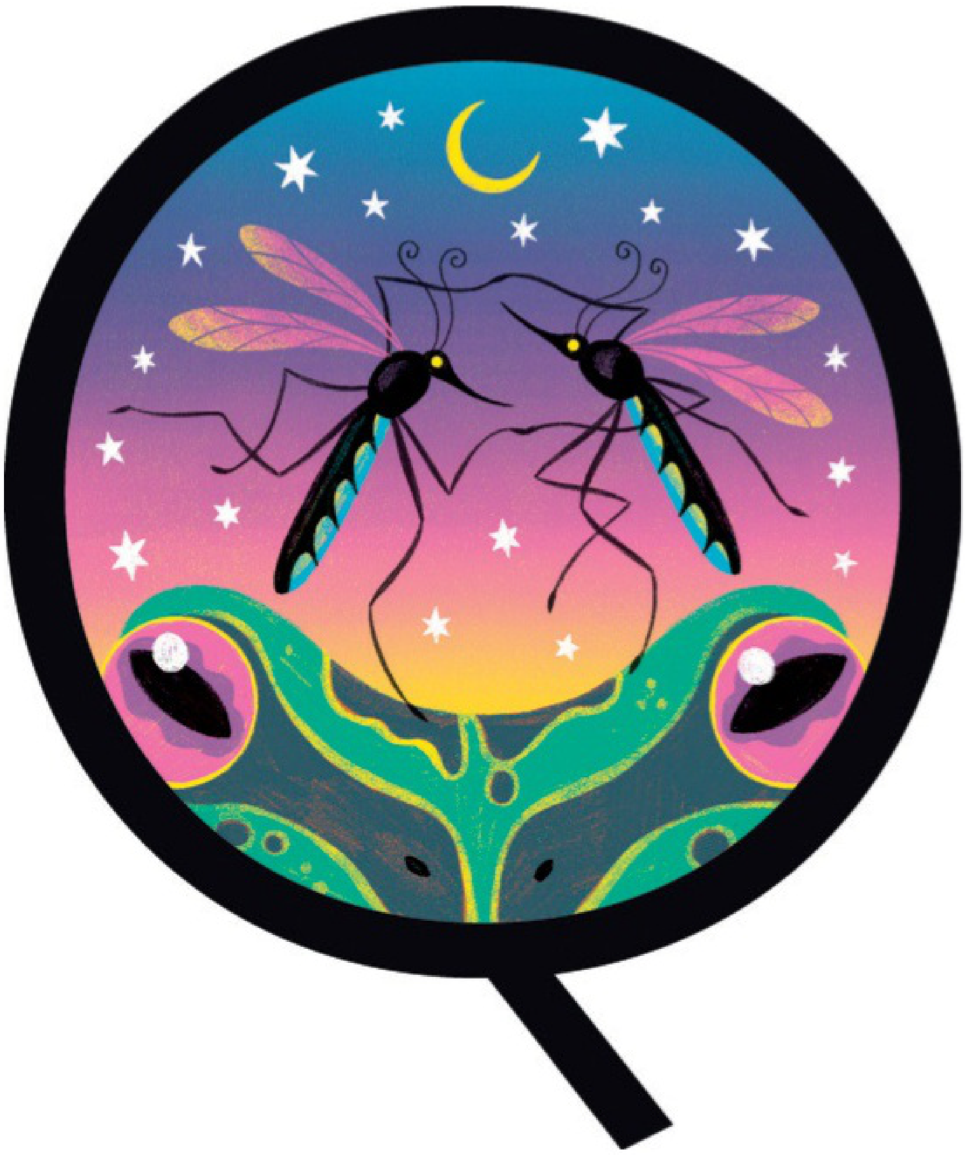

Q: What purpose do mosquitoes serve?

Lana Carlton | Bradenton, Florida

WHILE THEY CAN seem pointless and purely irritating to us humans, mosquitoes do play a substantial role in the ecosystem. Mosquitoes form an important source of biomass in the food chain—serving as food for fish as larvae and for birds, bats and frogs as adult flies—and some species are important pollinators. Mosquitoes don't deserve such a bad rap, says Yvonne-Marie Linton, research director at the Walter Reed Biosystematics Unit, which curates Smithsonian's U.S. National Mosquito Collection. Out of the more than 3,500 mosquito species, only around 400 can transmit diseases like malaria and West Nile virus to people, and most don't feed on humans at all.

Q: I read that a lioness may eat her cubs or let them starve. Is that true? Why would she do that?

Jeaneth Larsen | Mitchell, South Dakota

IF A LIONESS EATS HER CUB, it's likely because there's a problem: Either it was stillborn or died shortly after birth from natural causes. The mother consumes the remains so predators aren't attracted to it. Think of it more as a survival tactic than a brutal ritual, says Craig Saffoe, curator of Great Cats areas at the National Zoo. A lioness will feed her offspring milk unless she physically stops producing it, which might happen due to low food and water resources and could lead the cubs to perish. If the cubs are old enough to eat solids, they usually eat with the rest of the pride, but have to eat last and are usually the first to die off if resources are low. Grown adults generally eat first; that enables them to breed again as soon as resources return to normal.

Q: What was the origin of ZIP codes?

Rosanne Levitt | New York City

THE U.S. POSTAL SERVICE introduced the "zone improvement plan" (ZIP) code in 1963. The nationwide system mechanized more of the work of mail sorting, which had previously been done by hand, says Lynn Heidelbaugh, curator at the National Postal Museum. The idea dates to 1944, when postal inspector Robert Moon proposed adding a three-digit code to addresses; the first number referred to a region and the next two to a mail processing center. Two decades later, after mail volumes had grown exponentially, Postmaster J. Edward Day adopted a version of that plan, adding a fourth and fifth digit designating a specific post office. The Zip code has been expanded twice: Four additional numbers indicate what side of the street, or even hallway, the destination is on. Two more numbers sequence the carrier's route to make it more efficient.

Q: Why is the Republican Party represented by an elephant and the Democratic a donkey?

Anonymous | Washington, D.C.

PRESIDENT ANDREW JACKSON, who was supported by the Democrats in 1828, earned the nickname "Jackass" for his stubbornness, says Jon Grinspan, curator of political history at the National Museum of American History. The image stuck to the Democrats and took off after the Civil War, when they were seen as the defeated party that wouldn't accept its loss. Around the same time, cartoonist Thomas Nast started drawing a stumbling elephant to represent the Republican Party, once united by its abolitionist goal but struggling in the postwar years. Originally somewhat insulting, the two symbols were embraced in the early 20th century. ◆

Text by Anna Diamond

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